TRAFFIC ENGINEERING & CONTROL

THE UNIVERSITY OF MICHIGAN
APR 10 1961
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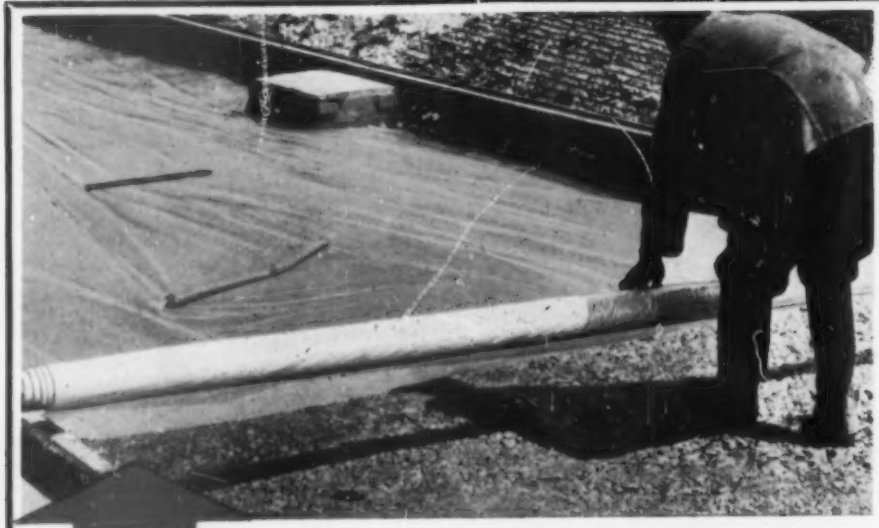

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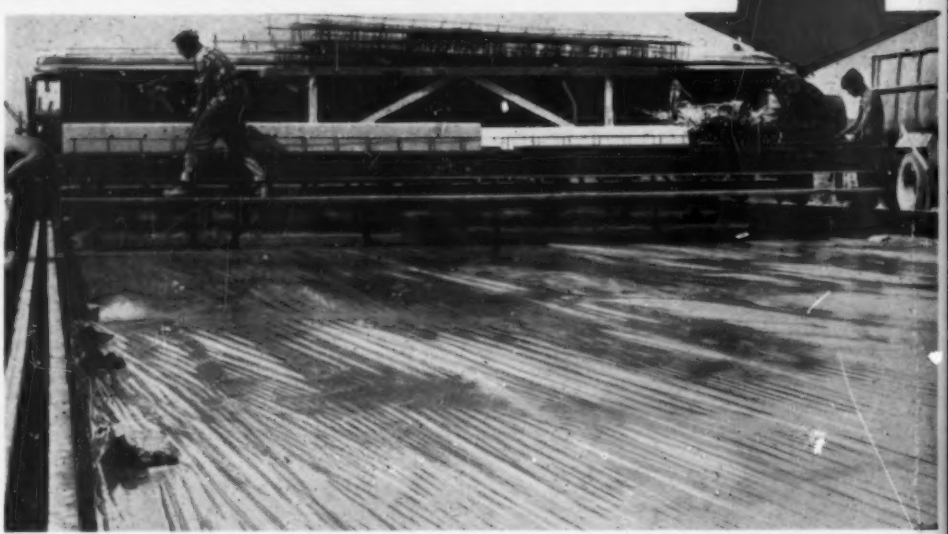

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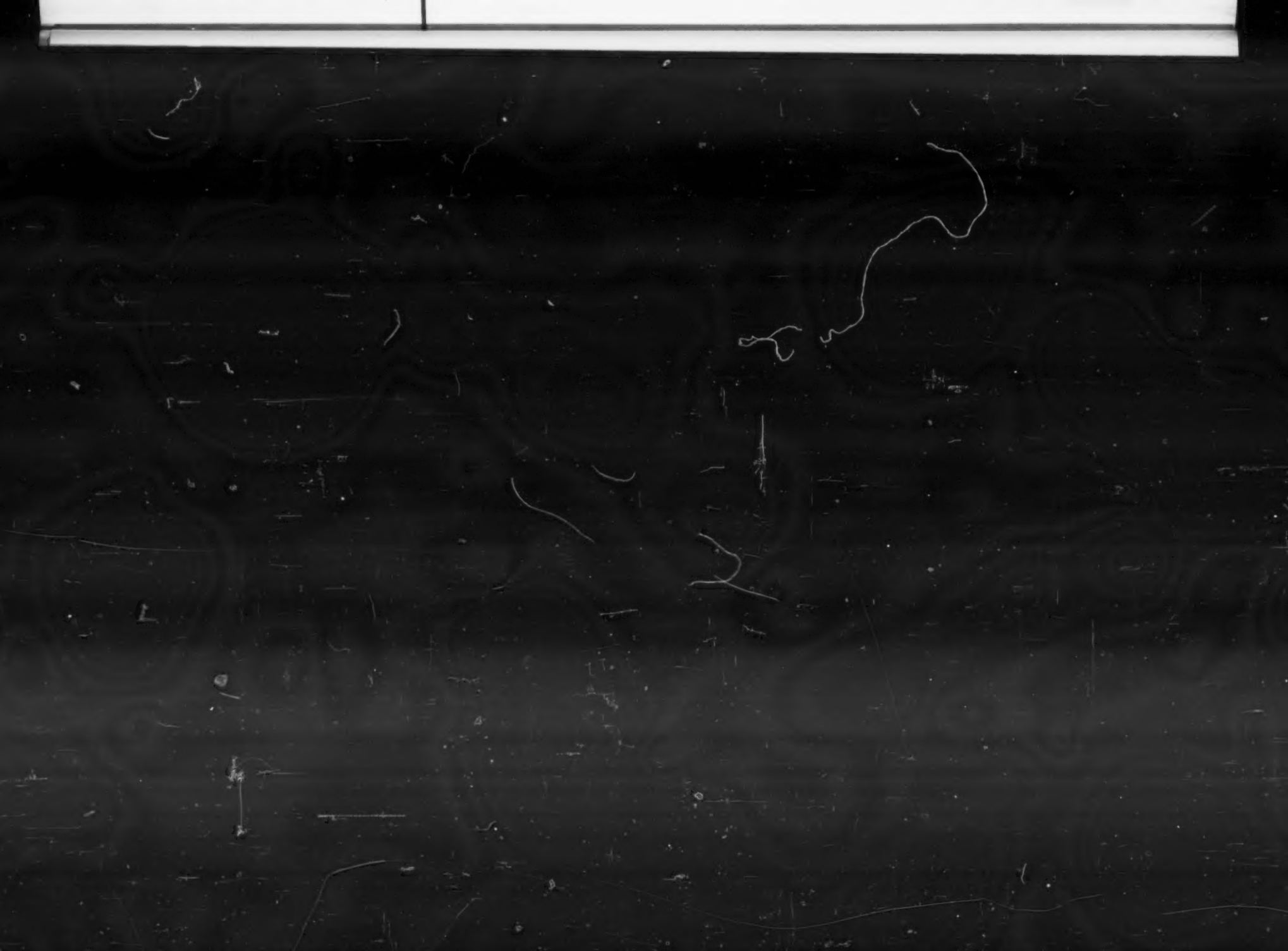

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VOLUME No 2 No 1 MAY 1960

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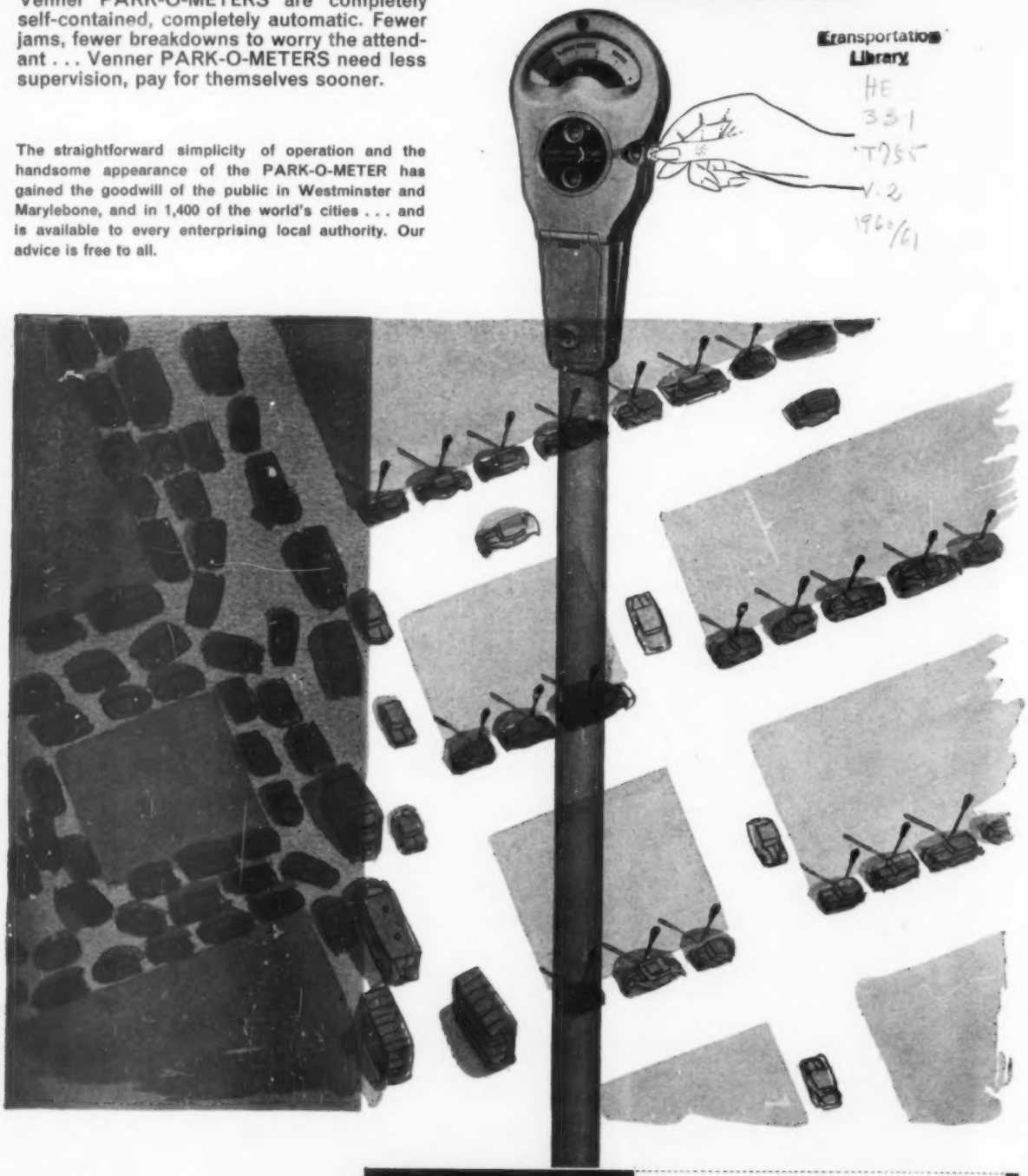

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The Purpose of this Journal

IN launching a new technical journal it is desirable at the outset to define its aims and objectives in order to justify adding to the vast volume of reading matter that is thrust upon the modern technician. Ours are simple: to make more widely available the methods and techniques of traffic engineering, to create a greater awareness of the results obtained from their application and from road and traffic research. This is our purpose because with a greater understanding of the contribution that traffic engineering is making, and can make, to the resolving of the problems that arise from increased motorization the greater will be the demand for its application and the wider its use. But it is important that its frontiers be demarcated and its limitations appreciated. Traffic engineering is not new, but its emergence as a specialized branch of civil and highway engineering is.

Briefly, it is directed at enabling the maximum capacity to be obtained from roads and traffic networks, from the construction of new roads and the improvement of old ones, and from the regulation and control of traffic. The methods and techniques of the traffic engineer are directed to ensure a continuous, fast, smooth and safe traffic flow along the roads and to enable vehicles to fulfil their function and to provide for them when they come to rest. By the collection of data on traffic pattern and behaviour, on its origin and destination, and by its analysis, the traffic engineer ascertains its volume, estimates its future growth and requirements and determines how best to provide for them. He is thus concerned with the design, planning and geometry of the roads, with their engineering and the materials employed in their construction, with access to them and with their intersection with other roads; with their furniture, signalling, signposting and marking, and with their lighting, to enable their practical capacity to be fully used and traffic congestion minimized.

It is important, however, that not too narrow an interpretation be placed on his functions, nor that traffic engineering be regarded as a panacea for all traffic ills. In America it has tended to become so highly specialized that often the traffic engineer is so concerned with the speedy movement of traffic that he provides for it at the expense of planning, of the priorities of land use and the preservation of community life. Ministerial statements show that that danger also exists here inasmuch as traffic engineering is to some extent looked to largely as a means of applying palliatives to meet immediate needs. It can do so in the short term, but that is only part of its task and its function of assessing future needs and planning for their satisfaction is more important in the long term. In this the traffic engineer cannot act in isolation, nor usurp the functions of others. He is but one of a team concerned with roads and traffic. Municipal engineers and county surveyors and highway and civil engineers, have all long applied many of his methods and techniques, and it is only with the growth of what often appears to be the intractable problem of traffic congestion, particularly in urban areas, and the rising danger on the roads, that the need for greater specialization in the regulation of traffic flow based on the collection and analysis of traffic data has been realized. It is here that this country is deficient. Immediate local needs are too often met piecemeal without sufficient regard to wider needs because they are based on inadequate knowledge of the local, regional and national traffic pattern and their inter-relationship. The primary task awaiting the traffic engineer, particularly in the larger conurbations, is traffic studies of whence the traffic comes, whither it wishes to go and the routes it prefers to travel. The need may be appreciated but the staffs of the appropriate authorities may be unable to carry this extra load. Only a score of municipalities have traffic engineering sections within their highway departments and there is a serious shortage of available specialized staff which is in part due to inadequate training facilities. The Ministry which purports to encourage greater use of traffic engineering would be well advised to require the larger authorities to undertake such surveys to assess long term needs and plan their road and traffic needs accordingly and should make the necessary grants.

The messages of welcome which this journal has received, and for which we are most grateful and appreciate greatly, indicate the wide measure of agreement there is among the professional institutions and the specialized organizations that there is ample scope for an extension of the use of traffic engineering methods in this country, subject always to its playing its specialized and limited role within the wider field of engineering of which it is a part and in full co-operation with all responsible for planning and development. In encouraging these things this journal hopes above all to make a practical contribution by bringing to its readers news and information of what is being done in the field, of projects undertaken and results obtained and of results of research, and thereby to enable its readers to share the experience of those at home and abroad who have successfully applied the science of traffic engineering to roads and traffic.

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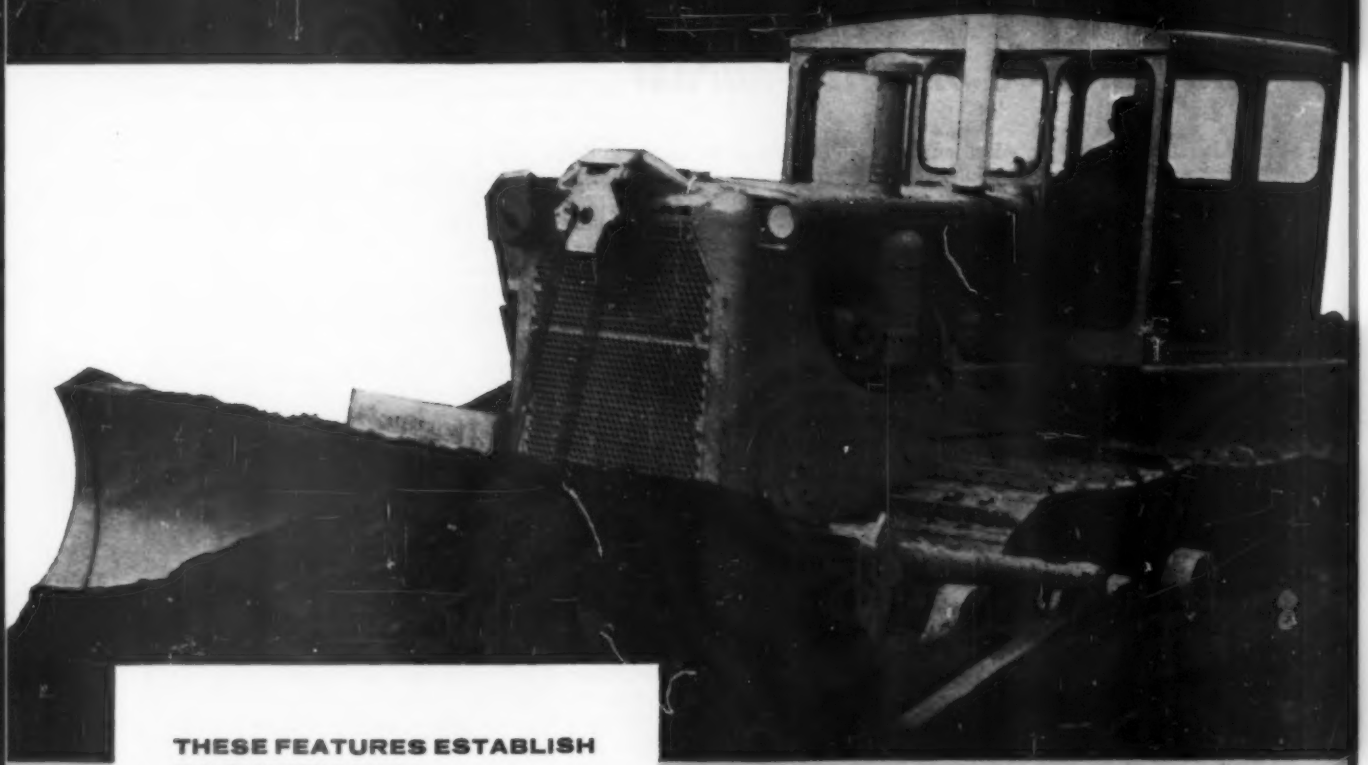

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Topics of the Month . . .

THE Road Traffic and Roads Improvement Bill now before Parliament is largely procedural, providing for acceleration of the present cumbersome procedure for the designation of parking schemes and provision of off-street parking, and, in certain cases, the making of traffic regulations. Its authorization of the ticket system, and of traffic wardens, under the police authority, should increase the effectiveness of traffic control and parking provisions by leading to stricter enforcement, although Parliament is rightly demanding greater safeguards against abuse by 'ticket-happy' wardens than the Bill provides.

Granting municipalities the right to take the initiative in regard to instituting parking schemes, including the use of parking meters and the Paris time discs, and the promulgation of traffic regulations in conjunction with them, although both are subject to Ministerial veto, is vesting responsibility for traffic regulation and control within urban areas where it rightly belongs. Local authorities are far better informed of local needs than the central government can be, and heretofore they have often found their powers insufficient to meet them. By authorizing local authorities to construct or adapt buildings for use as off-street car parks, and to provide the ancillary services necessary to their economic operation, should speed their provision, for without them no parking meter scheme, however strictly enforced, can adequately serve the needs of the motorist, commercial or private.

Accepting that the Bill as it applies outside of the Metropolis as very limited, it makes no major attempt to deal with main problems of roads and traffic congestion, but it should lead to the speedier provision of more on- and off-street parking more economically and accelerate the introduction of local traffic regulations aimed at an improvement of traffic flow.

Palliatives for London

IN its application to London, the Bill extends the Minister's powers presumably in order to enable the London Traffic Management Unit to initiate traffic schemes for improving traffic flow without waiting on the London and Home Counties Traffic Advisory Committee, the municipalities or the police. Since there must be dependence on the last to enforce regulations, and consultation with the local councils is essential to ensure that requirements of local communities are safeguarded, Dr. Charlesworth will require to proceed with tact if he is to succeed in speeding traffic movement in London. In any case, within his limited terms of reference he will be able only to introduce palliatives, but London needs more than palliatives.

Conrad Andren writes elsewhere in this issue of the deplorable lack of traffic data on which plans can be made, and in a report prepared for the Roads Campaign Council by experts who participated in their competition it is alleged there is no London traffic plan. One reason is the division of responsibility over a multitude of authorities, and the Bill cuts through that for a restricted number of functions for a temporary period, but any permanent solution must await the Royal Commission on London Government which has heard much evidence on the division of responsibility for London roads and traffic. Meanwhile, London's most urgent need is a comprehensive origin and destination survey covering the whole of the London Traffic Area because without the availability of this information major improvement schemes, however desirable they may appear in themselves, can only proceed piecemeal. Neither palliatives nor the exercise of the Minister's powers under the Bill to introduce improvement schemes when the highway authorities fail to do so, can be more than marginal. Nor are they any substitute for a long-term plan based on knowledge of needs projected over the next 20 years. A full-scale traffic survey of the pattern and behaviour of London traffic would enable this to be drawn and intelligently based.

London still has no roads and traffic plan and until it has, piecemeal road improvements and temporary traffic schemes can do little more than keep pace with the mounting volume of traffic, if that.

Roads Expenditure

LITTLE encouragement can be obtained from the Budget in regard to roads expenditure. The Civil Estimates for 1960-61 provide for increased expenditure of £13 million over last year, which on the face of it may appear gratifying, but one year's comparison with another is deceptive. Only by looking at the roads programme as a whole over a period can a true picture of the conversion of expenditure into works be obtained. Here the outlook is discouraging, because the last announced programme is running out and no further programme has been made known. The four-year programme to 1961-62 was for an expenditure of £280 million of which £250 million will have been committed by the end of the current financial year. This leaves only £30 million in the kitty, so failing a new roads programme and provision for further capital authorizations to implement it, the run down will be considerable in the years ahead. The extent can be gauged from the present outstanding commitments which were £143 million at the end of the financial year and are estimated to be £144 million by the end of this financial year. Substantial work will therefore still be in the pipeline, but with only £30 million remaining for new works to be authorized this year the run down will become rapid. Failure to announce the future roads programme makes planning difficult, if not meaningless, and means that work can only continue on its present *ad hoc* basis. This is evidenced by the estimated expenditure on motorways. Work in progress at the end of the financial year was about £60 million and commitments outstanding about £46 million. Commitments estimated to be outstanding at the end of the current year will, however, be only £22 million. While the Ministry of Transport took credit in launching the estimates for doubling of expenditure on motorways this year, from £11 million to £22 million, it understandably did not draw attention to the fact that work in progress at the end of the year will be less than half that at its commencement. These fluctuations in the roads programme are as unfortunate for the highway authorities as they are wasteful for the community. Expenditure on an annual basis, with no known regard to a long-term programme, makes the task of the planners and the highway authorities more difficult and less rewarding than a little more forethought on the part of the central authorities would render it.

TRAFFIC ENGINEERING & CONTROL

◀ THE EDITOR

Ernest Davies, Assoc.Inst.T.

author and journalist and Associate of the Institute of Transport, is a recognized authority on transport. As Member of Parliament from 1945 to 1959 he was Chairman of the Parliamentary Labour Party Transport Group, except while a junior Minister 1950-51, and was a leading Opposition front bench spokesman on transport matters from 1955 to 1959. In 1953 he took the initiative in forming the All-Party Roads Study Group in Parliament and was its joint Chairman up to the General Election of 1959. He is a regular contributor to transport journals, the Encyclopaedia Britannica and the editor of 'Roads and their Traffic' the first book to appear in this country devoted entirely to traffic engineering. Author of books and papers on road transport economics; he has contributed widely to the Press, and has addressed overseas conferences on road subjects.

THE BOARD

The Editor is assisted by an honorary Editorial Advisory Board comprising internationally recognized authorities on traffic engineering and allied matters including those who have pioneered its teaching and practice in this country, and by a team of editorial consultants.

Wilfrid Andrews

has been one of the most active people campaigning for an improved roads system in Britain and for the greater application of traffic engineering methods in this country. He is Chairman of the Royal Automobile Club and the Roads Campaign Council, which he took the initiative in founding, Vice-President of the Federation Internationale de l'Automobile, and of the Executive Committee World Touring and Automobile Organization (O.T.A.), member and Past President of the Standing Joint Committee of the Royal Automobile Club, Automobile Association and Royal Scottish Automobile Club.

Prof. W. Fisher Cassie

has been Professor of Civil Engineering in the University of Durham since 1943. He is a past Member of Council of the Institution of Civil Engineers and of the Institution of Structural Engineers. For the past five years the Highway and Traffic Engineering Section in his Department has led in traffic engineering education in this country. Under the leadership of Dr. T. E. H. Williams, the Section has been instrumental in prosecuting research, in providing post-graduate education and training to practising engineers, and in giving undergraduates an introduction to traffic engineering.

Christopher T. Brunner

is a director of Shell-Mex and B.P. Ltd., and also of the National Benzole Company Ltd., and the Power Petroleum Company Ltd.

Mr. Brunner is Vice-Chairman of the British Road Federation and a Vice-Chairman of the International Road Federation (London Office). He is past President of the Institute of Transport, and Chairman of the Road Research Board Committee on Economics, Department of Scientific and Industrial Research.

He is a member of the Grand Council of the F.B.I. and Chairman of the F.B.I. Road Panel of the Transport Users Policy Committee.

Sir William Black

is Managing Director of the A.C.V. Group and is also a member of the National Advisory Council for the Motor Industry.

Not only is he Chairman of the British Manufacturers' Section of the S.M.M. & T., but he is also a director of Charles Roe Ltd., Barfield Industries Ltd., and British United Traction Ltd.

His appointment in July 1957, as Chairman of the National Research and Development Corporation was recognition of both his abilities and the important part he has played in industry over a long period of years.

Sir William G. Holford

Chief Technical Officer, Ministry of Town and Country Planning 1943—1947 Sir William has been Professor of Town Planning, University College, London, since 1947, a member of the Royal Fine Art Commission since 1944 and is a member of the Historic Buildings Council for England. He is also a member of the Member Executive Committee of the Automobile Association and a part-time member of the Central Electricity Generating Board. As an architect of world wide repute he has been Planning Consultant to the City of London and other authorities at home and overseas, and was a member of the international jury for the town plan of Brasilia.

Granville Berry

since 1950 City Engineer and Surveyor to the City of Coventry, has been actively concerned with the reconstruction of the City Centre and the implementation of the road pattern. Member of the Institution of Civil Engineers and of the Council of the Institution of Municipal Engineers, he is also a Member of the Road Research Board and Chairman of the Street Lighting Sub-Committee of its Committee on Traffic Engineering, as well as representing the Association of Municipal Corporations on the British Standards Institution's Street Lighting Committees. A Past President of the Association of Public Lighting Engineers, he is also a Member of the British and American Illuminating Engineering Societies.

Editorial Consultant—Lighting

CONSULTANTS

Conrad Andren

M.Sc. (Eng.)., A.M.I.C.E., Dipl. T.P. (London), is a consultant, and was responsible for the surveys on which were based the British Road Federation's Reports on 'The Cromwell Road Extension Scheme', 1956, and 'Experimental Parking Town', 1958. Lecturer in the Department of Civil & Municipal Engineering at University College, London, from 1953 to 1960, he was formerly assistant to the late R. B. Hounsfield, pioneer of Traffic Engineering studies in London. Member of the Committee on Traffic Engineering of the Road Research Board, since 1957; Member of the Committee of the Traffic Engineering Study Group, Institution of Civil Engineers.

Editorial Consultant—Parking

.....Welcome to

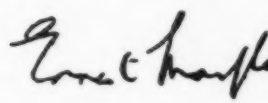
TRAFFIC ENGINEERING & CONTROL

from the Rt. Hon. Ernest Marples, M.P., Minister of Transport

There has been a rapid growth of traffic in the past few years. In 1959 the increase on main roads was 12 per cent. It is therefore imperative that we should urgently seek ways of coping with traffic and of living with the motor car, especially in our towns. We must plan for traffic in the widest sense. In doing this the planner, the economist, the police and the engineer all have important roles. In particular the traffic engineer has an essential part to play in improving the efficiency of our existing streets and in helping with the planning of new roads.

Traffic engineering has been carried out in the Ministry of Transport for many years. Since the war extensive research in the subject has been made at the Road Research Laboratory. Many highway authorities have traffic engineering units, but more are needed to tackle the growing problems of road traffic. I am pleased to see that professional institutions are taking a greater interest in the subject, and that universities and technological institutions are making available more opportunities for training in traffic engineering.

It is also most important that there should be a wider dissemination of information about traffic matters. It gives me pleasure to welcome this new journal devoted entirely to traffic engineering and control. I wish it every success.



Other messages of Welcome have been received . . . . .

from Sir Herbert Manzoni, C.B.E., President, The Institution of Civil Engineers

I look forward with interest to the first issue of *Traffic Engineering and Control*, and wish it all success in the future.

Traffic is one of the greatest problems facing Britain today. It concerns the lives of each and every one of us—and it is principally the Civil Engineer who will have to find the solution. Only by the widest dissemination of knowledge on all aspects can the problem be correctly understood and really constructive action materialize.

Interest in traffic engineering today is keener than ever before. The Institution of Civil Engineers has always been alive to traffic problems. This has culminated in the Traffic Engineering Study Group, which the Institution founded last November. It already contains more than 600 members, including several non-members of the Institution.

All of us who are engaged in some way or another in tackling the problem of free movement and safety on the roads, hope that your journal will play its part.

from David Watson, M.I.Mun.E., M.I.C.E., President, The Institution of Municipal Engineers

May I, on behalf of the Members of the Institution of Municipal Engineers offer you my warmest congratulations on your initiative and enterprise in deciding to publish a monthly journal devoted entirely to Traffic Engineering. I am sure this is a decision which will be welcomed by all those who are associated with the increasingly difficult problem of fitting the highways of Great Britain to cater for the ever growing demands of traffic.

I should like first to correct an erroneous and unfortunate impression created in the minds of the public during the past few years, that this is a new science which had its origin in the United States. This has unquestionably arisen from the fact that our American friends have simply been compelled, as a result of the high rate of car-ownership, to intensify the application of the scientific principles of traffic engineering, which basically have been well understood for several decades. It is well known that traffic is now increasing at the compound rate of eight per cent per annum. It might easily be that within the

next 20—25 years every family in the country will own a car instead of the present ratio of one in four. It therefore necessarily follows that we, too, must step up the application of the principles of traffic engineering with a sense of the utmost urgency, in town and country alike.

So far as I am aware the first large-scale exercise in traffic engineering in this country was the introduction of a comprehensive system of one-way streets in the City of Birmingham about a quarter of a century ago. Highway engineers to local authorities are daily applying themselves to carrying out the principles of traffic engineering in their normal work.

I have in mind such matters as traffic censuses; origin and destination surveys; 'before and after' studies; the analysis of statistical data which is a necessary preliminary to the design of new and the improvement of existing highways; the provision of parking accommodation; and the making of traffic control regulations for such matters as one-way streets, no waiting, unilateral waiting, speed limits, pedestrian crossings, 'Halt' signs and the like. It is obvious that all these aids to traffic movement are essentially functions of highway engineering and should be organized as a section of the Department of the Highway Engineer.

It is as a result of the full appreciation of the foregoing facts that there is no aspect of the work of the municipal and county engineer which has received more attention in recent years by our Institution than the subject of traffic engineering. An important section of our Final Examination syllabus is devoted to traffic engineering. It has been and continues to be the subject of papers at our Annual and District Meetings. It has taken a prominent place in the Summer, Autumn, and Spring Schools organized by our Districts. In my own West Midland District a week-end course entirely devoted to this subject was held at Westham Residential College, near Warwick, under the aegis of the Traffic Engineering Section of the Ministry of Transport. A similar course was held in March under the aegis of the staff of the Faculty of Highway Engineering of the University of Birmingham.

There is a growing realization on the part of the whole of the nation that, if we are to make any real impact on the mounting volume of casualties and congestion on our roads, there must be a great expansion in highway schemes of all kinds, which will call for team work of the highest order on the part of many who have expert knowledge on the various problems which must inevitably arise in carrying out an expanded programme on the lines envisaged. This is particularly the case in urban areas, affecting not only motorways but also all-purpose highways and especially those built to motorway standards. As, however, a team of itself never produced anything, it necessarily follows that at its head there must be an inspired and inspiring leader. I have no hesitation in saying, by virtue of his training, experience and local knowledge of the personal and physical factors affected, it will invariably be found that the chartered municipal engineer is the best equipped to correlate, for the ultimate decision of the highway authority he serves, all the relevant technical data which will be required to ensure that not only will the completed scheme be in accord with the most modern concepts of traffic engineering but, what is equally if not more important, that aesthetically it harmonizes with the area through which it passes.

For all these reasons, I am certain your new publication will have a wide appeal to the Members of our Institution and that one and all will be with me in wishing you well in your new and most timely venture.

from Mr. R. G. Grout, M.Inst.T., President, Institute of Transport

All users of the road—and who is not one?—are ever conscious of the problem of traffic congestion. Many are daily grappling with this problem and many are studiously working to find ways and means to ease it. Anything that will help to improve the circulation of traffic on our roads must be welcomed, and I am confident that a medium for the exchange of information and ideas can make a very important contribution.

There is still plenty of room at sea and ship-owners like myself are therefore less closely concerned with the object you are pursuing than other transport operators. Nevertheless, rapid and easy access to and from ports is of vital interest to us.

It is therefore with pleasure that I send you my good wishes for a successful launching of *Traffic Engineering and Control* and for the speedy achievement of its objects of condensing and co-ordinating the theories and successful application of traffic engineering, and acting as a clearing house for the interrelated problems.

from James Drake, B.Sc., M.I.C.E., M.I.Mun.E., F.I.H.E., President, The Institution of Highway Engineers

The value of traffic engineering in the development of an efficient road transport system has long been appreciated by the Institution of Highway Engineers and the Council has given every encouragement to its growth and recognition. It is, therefore, with pleasure that I welcome the tremendous step forward which is being taken by those responsible for the publication of *Traffic Engineering and Control*.

Whatever the contribution to the technical field I can visualize many benefits arising from bringing together representative viewpoints covering such a large section of those interests vitally concerned with road transport in this country. In the face of such progress we can have confidence that roads will never again go back into the slough of the immediate post-war decade.

It is only during the last two or three years that any major projects have been taken in hand and it is too soon for any appreciable impact to have been felt. However, we shall soon begin to see the parts of the road jig-saw falling into place and perhaps with the development of traffic engineering we shall ensure that the pieces do not go in upside down.

I have no doubt that *Traffic Engineering and Control* will stimulate the subject to such an extent that the country will eventually be able to call upon more and better traffic engineers. In the meantime established highway engineers will continue to strengthen their knowledge by trading experiences and this publication will be most valuable in supplementing the work and papers made available by the professional institutions.

In conclusion allow me to wish you every success and may your circulation increase as fast as the traffic grows on our roads.

from John L. Postlethwaite, F.R.I.C.S., President, The Royal Institution of Chartered Surveyors

Personal experience of time-consuming traffic delays has awakened almost everyone's interest in the problem of traffic. A new publication on Traffic Engineering therefore promises to secure a permanent place in the technical literature of this country, for it deals with matters of great moment to all whose professional concern is the improved efficiency of roads and the safety of those who use them.

Roads and traffic are important factors in the right use of land, and for that reason chartered surveyors are anxious to find solutions to current problems, because land and its proper use are a primary concern of the surveyor's profession. Land development must be co-ordinated with traffic arrangements, and this is a field in which surveyors and engineers have long been associated. I am sure that these and other professions will benefit by discussion of their problems in the pages of *Traffic Engineering and Control.* **For these reasons, I am glad to have this opportunity of giving my support to the launching of this new publication.**

from Sir Howard Roberts, C.B.E., D.L., J.P., President, The Royal Society for the Prevention of Accidents (RoSPA).

Whereas the functions of RoSPA lie primarily in the field of Education of road users through training and propaganda, the responsibility devolving upon Education's other two inter-related partners in the cause of Road Safety—Engineering and Enforcement—is also a heavy one.

The new science of Traffic Engineering is serving to focus particular attention upon the safety aspects of road design, layout, construction, signing, marking and usage in a way never previously attempted as an entity.

Apart from the Traffic Engineer's ability to make roads inherently safer for all road users, there is, in my view, a great psychological safety dividend to be derived from his work. I refer to reduction of the frustration which at present besets many drivers on our over-crowded roads and which tends to make them subject to impatience and intolerance—both great breeders of accident producing situations.

It is therefore with the greatest pleasure that I welcome this new publication *Traffic Engineering and Control* and trust that it will play a significant part in helping to attack one of the greatest scourges of this day and age—the toll of road accidents.

from Professor J. S. Allen, B.Arch., F.R.I.B.A., President, Town Planning Institute

I note with great interest that you are shortly to issue the first publication in this country dealing exclusively with *Traffic Engineering and Control.* One is always chary of the introduction of yet another journal which the professional man will feel he ought to read, but if there is a case for a new journal today then this must surely deal with the subject of traffic. The motorcar will be of increasing importance as a factor in Town and Country Planning, and the need to draw attention to the importance of traffic and to publish all available knowledge is, in my view, urgent.

There is, of course, the risk of over-specialization, from which the uncritical all too often get the issues out of focus. This has now been realized in the Universities, and I was delighted to learn that your Honorary Editorial Advisory Board includes eminent experts in fields associated with Traffic Engineering, including that of Town Planning. A similar approach has already been anticipated in Kings College, University of Durham, where both Professor Cassie's Civil Engineering Department and my own work in close and happy partnership. One cannot over-emphasize the need for land use professions to understand each other's approach and problems. **This is the spirit which, I am sure, animates your proposed publication and I am certain that it will be very well received. I offer you and your readers my sincere congratulations.**

from Basil Spence, O.B.E., President, Royal Institute of British Architects

All the great cities of the world are now battle-grounds between vehicles and pedestrians, and in many of them the motor-car has conquered the pedestrian. The size and urgency of this problem has inevitably led to the emergence of a specialized branch of engineering to attack it, and your new magazine will have the important role of laying lines of communication between the traffic engineer and all those of us who are anxiously awaiting the solutions he proposes.

I am therefore very glad to see the name of that eminent member of my profession, Sir William Holford, among the Honorary Advisors on the Editorial Board, and I am confident that he will put cogently and intelligibly the architect-planner's point of view.

We cannot disagree with Mr. Christopher Brunner that the motor-car has come to stay, that its numbers will increase, and that the social and economic survival of our cities and central areas depends almost entirely on acceptance of the fact, but we architects do look for a wide acceptance of another fact, namely that we in this country are in the process of carrying out some of the most mature town planning ideas in the world, designed to give a new lease to urban life.

We believe it to be possible to segregate cars and pedestrians without destroying the living town, for like Humpty Dumpty, once disintegrated, all the Queen's motors and all the Queen's traffic engineers could not put it together again. The architectural profession is willing and anxious to help with this problem.

I wish your magazine every success as a medium for discussing all sides of the problem, and hope it will make a considerable contribution towards reaching a civilized solution.

from Sir Brian Robertson, Chairman, British Transport Commission

No one who is concerned with transport, whether as having a responsibility for public transport or merely

as a private motorist, can have any doubts about the serious and urgent nature of the problem of road development in our country at this time. Our road system is inadequate today and will obviously be much more inadequate in a few years' time when many thousands of additional vehicles will have been poured into the traffic stream. The problem is perhaps most serious of all in the cities with their narrow congested streets which incidentally are too often used as garages.

The concern felt by government and local highway authorities with these tremendous problems is reflected in the large-scale programmes of capital investment in road construction and improvement schemes which are now going forward in various parts of the country. These schemes of course require an immense amount of careful planning and a great deal of hard work has been done and is still in progress to ensure that the available money is spent in the best possible way.

Into this field there has entered recently a new element, a new technique, that of the traffic engineer. As the result of his special experience and his prolonged study of traffic problems he brings an expertise which can be of the greatest assistance to our road planning staffs.

I congratulate all those associated with the production of *Traffic Engineering and Control* on their enterprise in founding a journal devoted to this form of engineering which promises to make such an important contribution to the solution of our traffic problems. I wish the journal and its editor every success in this aim.

from Sir Reginald Biddle, Chairman, The International Road Federation (London Office).

Today the impact of the motor vehicle on our pattern of living, and the dislocation and economic loss caused by traffic congestion, are matters of concern to each member of the community. Solutions must be found to the present traffic stagnation experienced in many towns and cities. The understanding of traffic engineering principles and their proper application is essential if any improvement is to be made. As a necessary pre-requisite, knowledge of the subject needs to be disseminated widely and a forum for discussion provided. This new publication, therefore, dealing exclusively with Traffic Engineering, is most welcome to all of us who are interested in road problems.

The International Road Federation has as its aim the promotion of road and road transport development throughout the world and regards as no less important than construction and improvement programmes progress in the optimum use of the motor vehicle on the road. Recognizing the importance of professional training, it sponsors various schemes to provide study facilities for overseas students in highway and traffic engineering at the post-graduate level and accordingly it views with particular pleasure one more addition to the as yet limited number of journals dealing with this specialized aspect of road design and traffic control.

In the United States, long a pioneer in the field, traffic engineering enjoys ever increasing recognition; in Europe and the Commonwealth advances too have been made in the systematic study of this question. It is fitting therefore that the U.K., faced with a daily ever more intractable traffic congestion problem, should now be contributing, through the first journal in this country to deal exclusively with the subject, to discussions on the methods and techniques of this newest and most topical of sciences.

A review such as this can play a vital role in adding to the body of knowledge of traffic engineering and through its articles and discussion features it should prove of the greatest value to the administrator and the engineer, to the specialist and the layman alike, and I wish it all success.

from Lord Derwent, Chairman, British Road Federation

Your publication, devoted as it is solely to traffic engineering, is welcome evidence of the recognition that it is a science in its own right. My Federation has long been interested in traffic engineering and, indeed, it took the lead over a decade ago in arranging for a paper on the subject to be read before a representative gathering in 1949. While public acceptance of the term traffic engineering is very recent, the science itself is nothing new. Every road which has been built in the world's history has been based, even though subconsciously, on traffic engineering principles in some degree or other, otherwise it could not have performed its function at all.

The definition of traffic engineering adopted by the Institute of Traffic Engineers of America—where the term originated over thirty years ago—is that it is 'that phase of engineering which deals with the planning and geometric design of streets, highways and abutting lands and with traffic operation thereon, as their use is related to the safe, convenient and economic transportation of persons and goods.' Its purpose is not confined to securing the maximum use from existing streets, valuable as this is.

Before new roads can be built or more efficient use be made of the existing system, it is essential to know what is required. This may range, on the one hand, from the construction of a major road project, such as a motorway, to, on the other, where to put a traffic sign, its shape, size and colour, and what message it should carry. Traffic engineering will supply the answers.

The universal application of traffic engineering techniques is fundamental to providing what is needed for the 'safe, convenient and economic transportation of persons and goods.'

I congratulate you on your enterprise in producing this publication which must result in a more general acceptance of the importance of traffic engineering in all its aspects.

The Editor wishes to acknowledge with thanks the many kind letters of congratulation and goodwill at the launching of this new journal.

TRAFFIC ENGINEERING'S UNUSED POTENTIAL

by W. FISHER CASSIE, Ph.D., F.R.S.E., M.I.C.E.

Pioneer of the teaching of traffic engineering in this country, the Professor of Civil Engineering at Durham University outlines the basic principles in traffic engineering, the problems with which it is concerned and the steps necessary to enable its potentialities to be fully exploited.

IN the decades of rapid development which have characterized the 20th century, minor branches of science and engineering have, on occasion, suddenly developed into important sciences in their own right. Such new developments are brought into prominence by changing social conditions, and, in turn, affect everyday life. A few years ago, electronics was a small section of the science of electricity: now, television has effected a social revolution.

In the field of highway engineering, the development of a need for the fundamental study of traffic flows is the latest example of this change of emphasis to a section of knowledge hitherto of minor significance. Traffic study, however, is by no means new. In 1847 an assessment, by means of a traffic census, was made of the economic advantage to be obtained by setting up a viaduct across the dip of Holborn Hill; the channelized lay-out at Hyde Park Corner devised in 1883 has been changed only in detail but is still today substantially the 19th century development. By the early years of this century, diagrams showing the intensity of traffic flows at intersections were used and are similar to those drawn today. There were technical discussions 50 years ago of central refuges, and of tidal flow, morning and evening, into and out of large cities. Parliament Square, which, in 1868, had been the site of the first experiments in gas-lit road traffic signals, was given, 30 years ago, the rotary circulation of traffic it has today. Since these days the complexities of traffic engineering have increased, but the tasks are still unchanged in type although expanded in scope. Traffic engineering may now have acquired a name and importance not hitherto accorded to it but our need is still for the fundamental study already familiar to highway engineers. We require more concentration and expenditure on traffic engineering, and many more young highway engineers trained in its principles.

Civil engineering has been called the most humane of the technologies for, at every point, the civil engineer's work brings him into contact with human beings. A study of the way in which individuals behave in given circumstances is, possibly, of greater value in traffic engineering than in any other field of technology. Moving vehicles are not inanimate, but are under the control of drivers whose human predilections and prejudices influence the nature and intensity of the traffic flow. It is not sound engineering to assume that individuals will, without guidance, act in the safest and most logical manner. The engineer must influence the decisions taken by vehicle drivers by making it easier for them to do the right thing than to do anything else. The influence exerted must be a positive one of acceptable control rather than a negative one of restriction.

Three Principles

THE argument is sometimes advanced that what applies to traffic in the United States or on the Continent does not apply to this country since we have different political and social systems. This is

Coventry's roof-top parking, multi-storey car park and heated ramp. A fine example of the provision of terminal facilities.

unsound, for, faced by similar highway conditions, individual drivers in Britain, Germany, France, U.S.A. and other countries of the West, behave in a similar fashion. Difference in reaction is likely only if the backgrounds of individual drivers are widely different. Drivers hesitated to pass through the first traffic lights in West Africa because of the dangers of the Evil Eye—something which perhaps would show no counterpart in Britain!

The first principle in traffic engineering, therefore, is that the problem is a human one and that solutions proposed should be directed towards the individual rather than towards a numerical agglomeration of inanimate vehicle units. Individual human beings, put into similar circumstances, behave in similar ways, and the principles of traffic engineering can be widely applied.

The figures illustrate the application of traffic engineering principles to street realignment in Brussels.

The second principle which must be borne in mind in the study of traffic engineering is that all plans for engineering construction, for the education of the public and for the enforcement of such regulations as are necessary, should be directed towards the full and safe enjoyment of the advantages of motor transport. The layman, and very often the City Councillor, too often thinks in terms of restriction and of the denial of the full use of the motor vehicle. While such restrictions may well be necessary for a short time, there is danger that, if adequate traffic engineering solutions are not eventually applied, the restrictions may well come to be looked upon as solutions. Restrictions on road transport have never been successful from the Middle Ages down to the present day when every pedestrian crossing, every traffic light, every 'no-waiting' sign, is a confession of our failure as a society to solve the problems confronting us.

A third principle which guides the engineer in traffic studies, is that assumptions, even those which appear to be perfectly obvious, must not be made. An unprejudiced study of the facts of traffic flow is essential. A great deal of expense might well have been saved between the Wars if this principle had been more carefully followed. It was often assumed that heavy traffic pouring through a town could be diverted by a by-pass. It was found, however, that for the larger towns, by-passes had little effect on congestion; most of the traffic had some reason to visit the business areas.

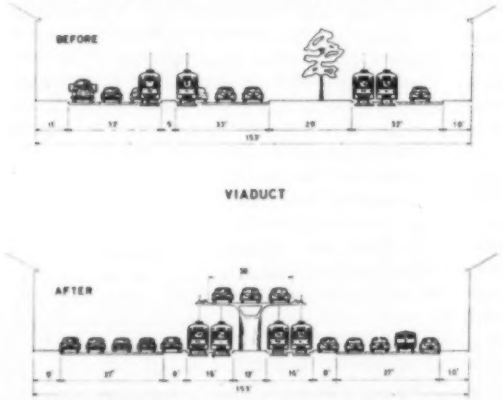
With these three principles in mind—of catering for the individual driver rather than for thousands of vehicles, of avoiding new restrictions and eliminating old ones as far as possible, and of taking nothing for granted without careful scientific survey—the highway engineer who is concerned with traffic engineering finds his solutions more efficient.

Three Problems

IN any efforts to obtain the greatest advantage from the use of the motor vehicle, traffic engineering is concerned with three main problems. The first of these is in the devising and distribution of terminal locations. We should never consider building an ocean liner if there were no docks for its reception, and an inter-continental airline would be inconceivable if carefully designed airports had not been constructed. We continue, however, to produce millions of motor vehicles, which have few logically designed terminals, and whose presence in our city streets constitutes one of the most damaging factors in our urban economy.

The second of the three branches of traffic engineering is the determination of how present roads and streets can be most effectively used by modern motor traffic. The provision of terminal facilities and the utilization of existing roads and streets in an efficient manner are interrelated. When standing vehicles can be removed from city streets, the capacity for traffic flow is greatly enhanced, and the gain to the city economy undoubted. The problem of providing places where vehicles can stop without restricting traffic flow is probably the most important aspect of traffic engineering today and one whose solution brings the greatest social dividends.

The third problem facing traffic engineering is that of deciding what new roads and streets are required and where they should be located. Decisions on this point require skill and experience on the part of the highway engineer in estimating the direction of



traffic trends and of how individual drivers will react when the new facility is provided. This third problem —that of devising and constructing new routes—must certainly claim attention, but emphasis is often laid on it to the exclusion of less spectacular aspects of traffic engineering of equal importance.

Two Preliminary Steps

THE techniques of traffic engineering which will be studied in the pages of *Traffic Engineering and*

Control are powerful, and have been shown to produce valuable results in the easing of traffic congestion. They are based on the scientific study of statistical and economic facts. Acceptable solutions can be built up from these facts only by engineers who have the experience and training to utilize to the full the potential power of traffic engineering—this rapidly developing branch of civil engineering.

In order that we may begin to utilize the unused potential of traffic engineering to the full, two positive steps must be taken. The first is that of obtaining continuously, and in many different parts of the country, information and attested facts about traffic flows. Highway engineers in Britain today realize that such continuous collection of facts and their interpretation is vastly expensive. It has not been undertaken yet on the scale which is necessary if we are not to guess in the future at how control is to be exercised. Without a greater emphasis on the staffing of traffic engineering departments of the offices of City Engineer and County Surveyor, the facts on which adequate solutions may be based will not be forthcoming. Collection of facts must be on a regional scale; local authority boundaries have no significance whatever in the problems of traffic flow. Major constructions for the alleviation of congestion at specific points in a city may well have the effect of increasing the congestion at other points unless regional studies have been carried out, and regional solutions developed.

The second and equally important factor in traffic-engineering development is that of providing, for the various regions, trained professional staff who have studied with some degree of specialization the problems of traffic engineering. There is no doubt that the number of professional civil engineers in this country today who have some knowledge of traffic engineering and are professionally engaged in its operation is increasing. The crowded attendances at meetings of the Traffic Engineering Study Group of the Institution of Civil Engineers is ample evidence on this point. This general interest and acquired skill is, however, not sufficient, nor is the number of professionally responsible men adequate for the amount of work which must be tackled in an informed manner. There ought to be set up, in each region, a training centre where courses in all aspects of traffic engineering are run for the benefit of the engineers of the area. Such regional centres might well be attached to the universities, as they are in some parts of the United States, and the instruction should be flexible in type, from full degree courses to evening classes for those who are likely to be traffic engineering assistants, enumerators and interpreters of the facts collected. These traffic engineering centres would not only help to solve *ad hoc* problems of the surrounding authorities, but would also carry out fundamental research. The charges made for surveys and for advice on specific problems would help to finance the fundamental researches and to encourage research and study by the members of the centre, both at home and abroad. Teaching members of the centres would also be encouraged to travel, for international contacts, whether made privately or at conferences, are of particular value in traffic engineering.

It is not too much to say that these two steps, and others related to them, are vitally important for the future well-being of this country. Without the continuous collection of basic facts, the estimation of trends and tendencies and the study of economic and social factors, a broad plan to develop control of the motor vehicle cannot be produced. Such collection of facts must be made on a regional basis without any specific object in view. Too often facts have been collected too late, and only in the immediate vicinity of some urgently needed construction.

Further, unless the second step, that of providing adequate professional training at a high intellectual level, is not taken, interpretation of the facts collected will be inefficient, and even the method of their collection may well be open to question. The training centres must give instruction in town and country planning, in the architectural development of cities, and in the social problems which result from the use of the automobile, in addition to technical guidance in traffic engineering techniques.

The motor vehicle can be of benefit to urban civilization but it can also, as has been shown in other countries, be a factor in urban sprawl, and in the decay of the centres of our great cities. In the United States, the automobile has hurtled the city limits outwards to produce a centrifugal spread very difficult to halt unless plans are made well ahead. The technical apparatus, the techniques, the devices, and the powers of traffic engineering are well known. Only by obtaining facts on which to use these techniques, and by producing trained men, can we hope to apply the unused potential of traffic engineering in the battle to maintain the automobile as a servant and not as a master.

NEXT MONTH'S CONTRIBUTORS include

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Dr. R. J. Smeed
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Burton W. Marsh
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American Automobile Association

Brigadier R. F. E. Stoney
Director-General Royal Society
for Prevention of Accidents

and

Profile of Sir Herbert Manzoni

AMERICAN REPORT

TRAFFIC ENGINEERING
Proves its worth

by ***BURTON W. MARSH***

Director, Traffic Engineering & Safety Dept.
American Automobile Association

FIRST, may I heartily commend the idea of a British monthly publication devoted to the theory and practice of traffic engineering. Second, may I thank you for being invited to prepare an introductory article for your first issue. Third, may I again express my appreciation for the opportunity afforded me by the *Daily Telegraph* last Spring, to spend over a month of observation and study of British road and traffic matters. Fourth, best wishes for a long life for *Traffic Engineering and Control*, noted for practical usefulness, sensible vision, and stimulation of increasing professional achievements.

Where Britain Lags

While appropriately, I have been asked to write regularly for *Traffic Engineering & Control* in terms of U.S.A. experience, in doing so my experiences in your country will be ever in mind, as will the hope that something I write will be helpful to some of its readers. Certain facts will be constantly before me—including the fact that Britain has some 37 per cent more vehicles per mile of road than the United States, that more than half a million new vehicles are registered there each year, as well as the huge numbers of 'L' tags which I saw everywhere, the excellence of your Road Research Laboratory and the numerous keen-minded and progressive leaders of various types with whom I was privileged to confer. Yet, what to me is so surprising is the inadequate importance-rating which you seem to give to what we term highway transportation—roads and traffic—and the limited funds you devote to it, and the all too widespread reluctance of many in key positions to give warranted recognition to the importance of devoting more attention to the effective, convenient, attractive and safe use of roads, and especially urban traffic facilities.

Lessons from Rail and Air

Because of professional obligations, it has been necessary for me to write this article while making a 6,000 mile cross-continental trip by rail. One beneficial result has been to direct thought to certain developments in our railroad history which, much later, have occurred in our highway transportation. Permit me to cite a few:

1. In the early days of railroad development, major emphasis was on location and construction of the railroad tracks—including adequate strength and durability of rails, ties, etc.,—and on the engines and cars to be used. Later, emphasis shifted to operations—to scheduling, freight handling, headways, signal systems and other protective devices, terminals and their efficient functioning—in other words, to efficient and safe *Use*. And for many years, the emphasis has remained there! Nobody questions the logic or appropriateness of emphasis on operations on the railroads—why should they question a parallel development in emphasis on highway transportation?
2. From the first, railroad managements recognized that through-destined rail traffic had to have 'fenced-off' or private rights-of-way. How long it took us in road transport to come to a similar recognition and start building controlled-access freeways, as we call them—motorways to you.
3. Railroad managements long ago recognized that to handle heavy traffic efficiently in major urban areas, separation from local street traffic must be attained.

In aviation too, consider the emphasis on efficient and safe operations. Think of airport control towers, their highly skilled specialists, flight plans, the intricate and expensive electronic approach and landing systems, landing and take-off scheduling, the many safety requirements. Here again there is ready general acceptance of operational measures—indeed, more and more improvements in operation are welcomed, expensive though they are. Why isn't the basic parallel as to highway transportation more generally accepted?

Traffic Engineering in USA

Mayor William McGee of Pittsburgh, Pennsylvania, in 1924 was, I believe, the first city executive to decide

Pioneer of traffic engineering, a doyen among American traffic engineers, with 35 years of experience in the field, Burton W. Marsh, assisted by William L. Casson, traffic engineer also working in the Traffic Engineering & Safety Department of the A.A.A., in Washington, will contribute a regular monthly report on developments in the theory and practice of traffic engineering in the United States.

to hire a City Traffic Engineer to devote full time to solving or remedying *existing* traffic problems (which were many and serious) and to avoiding *new* traffic difficulties through better traffic-oriented planning and design. I was the fortunate young man chosen for the job. My experience in engineering and city planning helped—but much that was new had to be learned about traffic through study, investigation, experimentation, adaptation, inductive reasoning, trial of new concepts, etc. The pioneer in state traffic engineering, Harry Neal of Ohio, preceded me—and a few others did too, though not, I think, on a full-time basis.

What early traffic engineers were able to accomplish apparently was considered not only worthwhile but important. For, it has always cost considerable money to set up an effective traffic engineering unit in government—and our cities, counties, and states always have serious budget problems. Nonetheless, there has been a steady increase in traffic engineering in city, state and Federal government and today there are over 900 government-employed persons who are members of the professional Institute of Traffic Engineers—and there are several hundred others governmentally employed as traffic specialists who are not yet members of ITE.

Hence, it may properly be said that traffic engineering has proved its worth in the United States of America—at least to a very encouraging extent and to any who doubt its solid acceptance, let me ask:

Why has Chicago, which ten years ago had a traffic engineering staff of 20, increased it to last year's total of 120?

Why is a large proportion of Detroit's Street and Traffic Department budget of some $1,400,000 devoted to traffic engineering?

Why, in both of those cities, and in numerous other cities and states, must all plans for new highway transportation facilities show the approval, through signature, of the traffic engineer?

Why in numerous cities have the traffic engineers been given 'cabinet status' in the city government?

Why do city-employed traffic engineers' salaries extend to over $20,000 per year?

In considering these questions, it should be borne in mind that our cities have very serious budget difficulties annually.

Looking Forward

It is estimated that by 1970 our street and highway traffic will have increased nearly one-half (46 per cent). There is also a very marked trend to urban-suburban living. Indeed, by 1970, about three-quarters of our total population will be living in or near an urban community. Not even the most optimistic, informed highway transportation specialists expect the development of new streets and highways to keep pace with mushrooming traffic volumes, especially in urban-suburban areas.

There is only one conclusion which can be drawn from that situation: very greatly increasing emphasis must be placed on traffic engineering so as to get—and so as to retain with changing conditions—the maximum of efficiency, convenience and safety in use of existing roads and streets. This point applies with special force to city traffic engineering.

Therefore, the need for more and better traffic engineering in the future is clearly evident.

This need for more, higher quality, and more advanced traffic engineering is challenging. A number of developments in the USA bearing upon this needs warrant brief listing here, and some may warrant more extensive presentation later.

Traffic Engineering Courses. This need is, of course, recognized and being worked on by keen leaders in the field of traffic engineering education at our universities which present such courses.

ITE Workshop. The Institute of Traffic Engineers gave special recognition to professional qualifications, technical development, organizational improvements, etc. in a well-prepared-for Workshop Conference at Highland Park, Illinois, in 1959 which resulted in 64 recommendations.

ITE Regional Freeway Operations Seminars. During the past two years, the Institute of Traffic Engineers has sponsored twelve regional seminars or conference, on the many special problems of freeway operations. Discussion leaders were specially qualified ITE members, leading specialists in the U.S. Bureau of Public Roads and police leaders. For three days and two nights, an average of 100 persons explored and discussed the many problems of effective freeway operations, and what should be done about them. Cities, counties, states and the Federal Bureau of Public Roads had enrollees. There were specialists in

(*Concluded on page 28*)

Traffic engineering practice in U.S.A.

BEFORE and AFTER STUDY...

TRAFFIC EFFECTS of STRAND WIDENING

By R. F. F. DAWSON, B.A., F.S.S.

Road Research Laboratory, Department of Scientific and Industrial Research

During the winter of 1958-9 the Strand, London, was improved to provide a uniform width from Wellington Street to Charing Cross Station. This entailed widening by 20 ft. (40 ft. to 60 ft.) from opposite William IV Street to Duncannon Street, 190 yards and consequent realignment for a further 60 yards to Northumberland Street (see Fig. 1).

In order to examine the effects of the widening, a 'before and after' study was carried out on the 29th and 30th October, 1958 and on the 7th and 13th May, 1959.

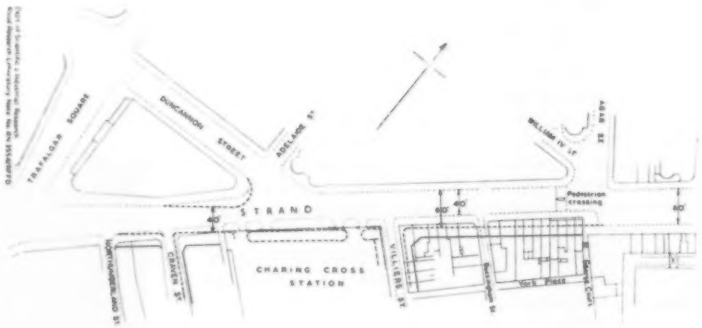
From the point of view of this improvement the Strand falls into three sections: the unwidened section east of William IV Street, the widened section where there is two-way traffic and the western section where there is one-way traffic—westbound along the Strand, part of which was realigned, and eastbound along Duncannon Street which was unaltered (see Fig. 2).

As a result of the improvement the combined journey speed in both directions increased from 8.0 to 10.1 mile/h. and the combined running speed from 11.9 to 14.5 mile/h., but the increases were considerably greater for the eastbound than for the westbound traffic. The increases were experienced in the unwidened as well as in the widened sector. Stopped times fell considerably. There was a small but non-significant increase in traffic flow during the period.

The estimated cost of the improvement was £278,720 and, after adjusting to compensate for the small increase in traffic flow, the increased journey speeds were estimated to yield savings in costs of £41,000 per annum or 15 per cent of the capital cost.

Method

The journey times and stopped times were measured in each section by the method given by Wardrop and Charlesworth[1] for a total of 30 runs in each direction on a Wednesday morning and a Thursday afternoon for both the 'before' and the 'after' study. (On three runs in the 'before' study the queue of westbound traffic at Villiers Street stretched back into the centre section and stopped time for these runs cannot be divided between the two sections.) At the same time the traffic flow was measured by eight standing counts of five minutes in each direction at a point in each section.



N.B. Buckingham Street intersection with the Strand was closed when the 'before' study was made

Scale 88 ft. to one inch

Fig. 1. STRAND WIDENING – DETAILS OF IMPROVEMENT

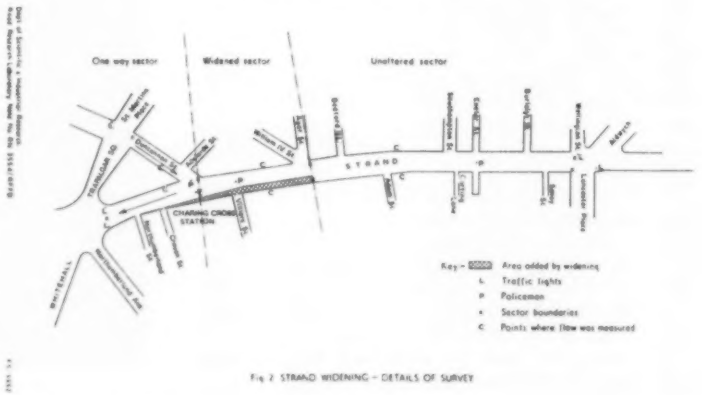


Fig. 2. STRAND WIDENING – DETAILS OF SURVEY

Results

Over the whole distance between Wellington Street and Trafalgar Square and considering traffic in both directions, the journey speed increased from 8.0 miles/h. to 10.1 mile/h., the running speed (i.e. speed based on journey time less stopped time) from 11.9 mile/h. to 14.5 mile/h. and the flow from 2,180 vehicles/h. to 2,250 vehicles/h.

The total flow weighted by length of sector increased by 3.5 per cent (see Table I) there being an increase of 7 per cent in the westbound traffic and no change in the eastbound flow. This increase is not statistically significant, although over a period of seven months an increase of about 2 per cent would be expected, for as the Laboratory's traffic surveys show, traffic in London increases by about 4 per cent per annum.[2]

The detailed results for traffic speeds in each direction and in each section, given in Table II, show that speeds

TABLE I

Traffic flow in the Strand 'before' and 'after' widening (vehicles/h).

	One-way sector (Trafalgar Square to Charing Cross)		*Widened sector* (Charing Cross to William IV Street)		*Unaltered sector* (William IV Street to Wellington Street)		*Average*	
	Before	After	Before	After	Before	After	Before	After
Eastbound	790	820	830	1,020	1,150	1,070	1,020	1,020
Westbound	1,190	1,320	1,170	1,160	1,140	1,230	1,160	1,230
TOTAL	1,980	2,140	2,000	2,180	2,290	2,300	2,180	2,250

TABLE II

Journey speeds and running speeds in the Strand 'before' and 'after' widening

	One-way sector (Trafalgar Square to Charing Cross)		*Widened sector* (Charing Cross to William IV Street)		*Unaltered sector* (William IV Street to Wellington Street)		*Total length* (Trafalgar Square to Wellington Street)	
Length (miles) East to West	0.064		0.086		0.238		0.389	
Length (miles) West to East	0.080		0.086		0.236		0.402	
	Before	After	Before	After	Before	After	Before	After
Journey Speeds (mile/h.)								
Eastbound traffic	8.4	12.3	8.8	15.4	7.0	9.3	7.6	10.6
Westbound traffic	5.6	7.0	7.3	8.9	11.2	11.6	8.4	9.7
Both directions	6.6	8.7	8.0	12.1	8.6	10.4	8.0	10.1
Running Speeds (mile/h.)								
Eastbound traffic	11.7	13.9	10.2	15.5	12.2	15.6	11.6	15.3
Westbound traffic	11.9	14.6	10.9[1]	12.9	12.5[1]	14.0	12.2	13.8
Both directions	11.8	14.3	10.6[1]	14.1	12.3[1]	14.8	11.9	14.5

[1]Based on 27 runs only

TABLE III

Average stopped times at controlled intersections (Figures in brackets denote number of stops in 30 runs)

Site	Type of Control	Eastbound		Westbound	
		Before	After	Before	After
Trafalgar Square	Traffic lights			27 secs (20)	21 secs (22)
Charing Cross Station	Police	8 secs (19)	2 secs (7)	4 secs (8)	4 secs (9)
Villiers Street	Police	5 secs (9)	★ (2)	15 secs (16)	7 secs (13)
Exeter Street	Police	16 secs (12)	1 sec (4)	8 secs (13)	13 secs (15)
Wellington Street	Traffic lights	36 secs (25)	37 secs (24)		
Total stopped time (secs)		65	40	54	45
Stopped time as percentage of journey time		35	30	31	33

★Less than half a second

TABLE IV

Changes in journey times

Direction of traffic	Journey times			Amount of decrease attributable to:	
	Before (secs)	After (secs)	Decrease (secs)	Decrease in stopped time (secs)	Increase in running speeds (secs)
Eastbound	184	132	52	24	28
Westbound	171	149	22	8	14

increased in all sectors and not only in those directly affected by the widening, though when results for both directions are combined the proportionate increases were greatest in the widened sector. The absolute and percentage increases in speeds for eastbound traffic were over twice those for the westbound traffic. This is still the case if an adjustment is made to allow for the slight increase in westbound flow.

For eastbound traffic all the changes in journey speed and in running speed are statistically significant; for westbound traffic both overall changes are statistically significant but the changes in journey speeds in the separate sectors are not. The changes in running speeds are significant in the altered sector and in the one-way sector but not in the Wellington Street to King William IV Street sector (where only 27 of the runs in the 'before' study could be used).

The stopped times (see Table III) decreased at nearly all points. As a percentage of journey time they decreased for the eastbound traffic but were virtually unchanged for the westbound traffic. If the terminal stops are excluded then average stopped time for eastbound traffic decreased from 29 to 3 secs, this change is statistically significant but none of the other changes in stopped time is significant. The decreases in the number of stops for eastbound traffic at Charing Cross, Villiers Street and Exeter Street are all statistically significant. The site where the stopped time decreased most, both absolutely and proportionally, was at Villiers Street near the middle of the widened section.

The total decrease in journey time was partly attributable to the increased running speed and partly to a decrease in stopped time; the change in journey time and the reasons for it are shown in Table IV.

Economic Effects

For eastbound traffic where the flow was unaltered at 1,020 vehicles/h. the journey speed increased from 7.6 miles/h. to 10.6 miles/h., and as the distance was unchanged the costs per vehicle mile would fall. Using the formula given by Reynolds,[3] the costs per vehicle mile were found to fall by 3.8d. from 17.3d. 'before' to 13.5d. 'after' the improvement. For westbound traffic, when speeds are adjusted, according to the speed/flow relationship given by Wardrop[4], to a flow of 1,200 vehicles per hour, the 'before' and the 'after' journey speeds became 8.1 miles/h. and 10.0 miles/h.; this change represents a fall of 2.4d. in the cost per vehicle mile from 16.5d. to 14.1d.

Assuming a 12-hour day and a 310-day year, the annual number of vehicle miles is:—

for eastbound traffic:—

1,020 vehicles/h. x 3,720 hours x 0.389 miles = 1,475,000 vehicle miles.

for westbound traffic:—

1,200 vehicles/h. x 3,720 hours x 0.402 miles = 1,795,000 vehicle miles.

The annual saving is therefore:

1,475,000 x 3.8d. + 1,795,000 x 2.4d. = 9,900,000d. or £41,000.

An annual saving of £41,000 gives a rate of return of 15 per cent on the cost of the improvement which according to the Ministry of Transport was £278,720.

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[3] REYNOLDS, D. J. 'Assessment of Priority for Road Improvements'. *Department of Scientific and Industrial Research, Road Research Technical Paper*, No. 48, London, H.M.S.O. (*In the press*).

[4] WARDROP, J. G. Some theoretical aspects of road traffic research *Proc. Instn. Civ. Engrs.* June 1952.

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American Report

(*Concluded from page* 25)

planning, design, construction, operations, maintenance, enforcement, education. A new realization of interdependence and of need for teamwork resulted —also realization of the urgent need to develop answers to numerous unresolved problems (such as communications in case of accident or breakdown, and identification of location of a car in trouble, especially where interchanges are far apart). A summarized report on these seminars is being prepared, and it will further extend their usefulness.

Sagamore Conference on Highways and Urban Development. In October 1958, a significant conference was held at the Sagamore Conference Centre of Syracuse University on 'Highways and Urban Development,' at which there was a new spirit of teamwork in dealing with the very important relationships of highway improvements to the general planning and development of cities. In this case, highway engineers were the group most prominently involved, and they worked for a week with city planners, educators and others in a highly productive way. The printed report is being extensively and effectively used—and other effective action has already been inspired by the Conference.

Conference on Theory of Traffic Flow. In December 1959 the General Motors Corporation sponsored, at its Technical Centre near Detroit, Michigan, a very significant two-day conference mainly for mathematicians and other scientists on theories of traffic flow. Various persons presented mathematical models through which they sought to express certain aspects of traffic flow. These models were discussed, as was the entire concept of applying theoretical mathematics to traffic. A number of persons attended from overseas. This was the first such conference in the U.S.A. and it is hoped that there will be others, for the traffic field could benefit greatly if the interest of persons of such special high qualifications is maintained in highway transportation.

Updating and Improving Traffic Devices Manual. A project of great practical significance to traffic engineers is now underway—the extensive revision of the 'Manual on Uniform Traffic Control Devices.' This is a manual of national standards for traffic signs, signals, and markings—with some limited content also as to islands. It will contain new material as to expressway signing, civil defence signs, and special signs for use during construction and maintenance work. In general, there are standards for sign design (including reflectorization or illumination) and sign locations; signal design, location and operation; and marking design and location. There are also warrants for the use of various traffic control devices. Scheduled to be finished before the end of 1960, the new Manual will presumably be either adopted as it stands by states or will serve as the basis for a state manual which it is reasonable to expect will be in close accord with the national Manual. State manuals govern design and use of traffic control devices in each state—though there are differences in the extent to which cities and counties are bound by the state manual, especially on non-state-aided roads and streets.

In the case of the National System of Interstate and Defence Highways, a 41,000 mile network of top national importance to the cost of constructing which the Federal Government pays 90 cents out of each 100, there is a separate printed sign and marking manual and it is mandatory as to all parts of the 'Interstate System.' The new manual will be in general accord with that governing Interstate System highways.

'The Federal Role in Highway Safety.' In 1959, this excellent, comprehensive report was printed. It was prepared by the U.S. Bureau of Public Roads principally by Charles W. Prisk. It deserves special review in a later U.S. Newsletter.

Intensive Inter-Disciplinary Accident Studies. Two intensive case history studies of traffic accidents are now under way: one, under the outstanding leadership of J. Stannard Baker, of Northwestern University and the other under the enthusiastic leadership of Dr. Alfred L. Moseley, of Harvard—the latter involving some $809,000 for a five-year project. In each of these cases relatively small numbers of serious or fatal accidents are investigated in depth by teams made up of specialists with different talents and experience, including an engineer, a doctor, a psychologist or psychiatrist, and, in one case, a sociologist. Such *inter-disciplinary team-work* will, I am confident, prove highly beneficial to the better understanding of traffic accidents and to methods of reduction.

Enforcement and Driver Behaviour Study. A $210,000, three-year study of the effects of different enforcement factors or approaches on driver behaviour. This study, too, is to involve a team of different types of specialists bringing their talents and experience into combination in seeking the truth. This study is under the over-all direction of Ray Ashworth, Director of the International Association of Chiefs of Police, Field Service Division.

London's Need of TRAFFIC DATA

by

Conrad Andren

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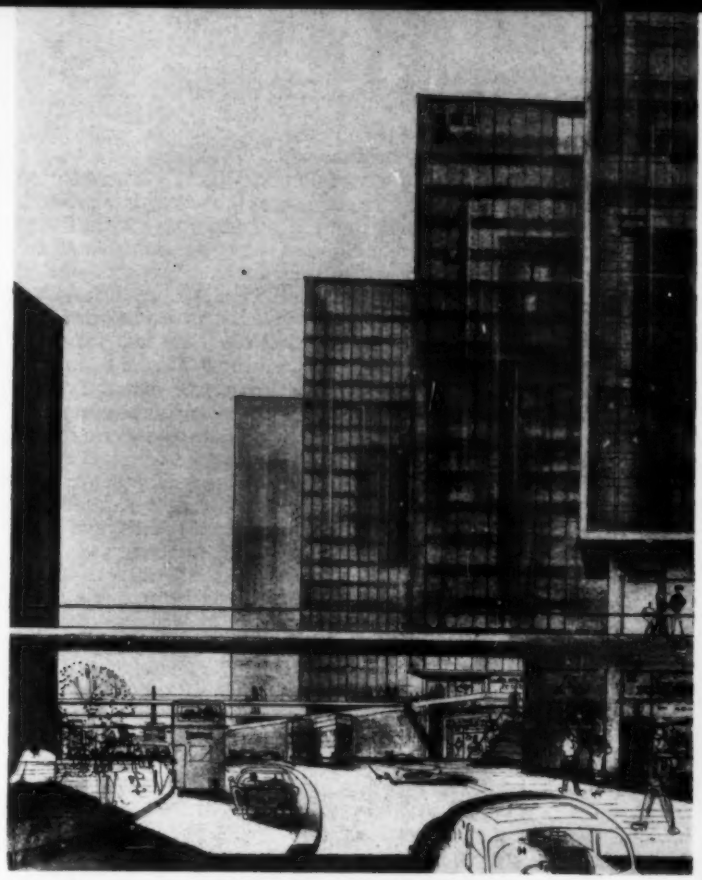


Pedestrian walk, Barbican Scheme, City of London.

WHY have not London's traffic problems been tackled? In the past, one reason has been that the fundamental principles for coping with traffic have not been agreed between the technicians and the administrators. Of course this failure has been due partly to the almost complete lack of funds for urban roads since the war. But now there is at least some money to be spent and it is becoming more and more obvious that, in addition to more money, we need more engineers trained in traffic work, more co-operation between them and town planners and less division of responsibility amongst administrators and police in the day-to-day operation and control of traffic on the streets.

Urban traffic calls for both short-term and long-term measures. Traffic engineering techniques need to be applied to both. Broadly speaking, there are two classes of work to be tackled: designs for new traffic arteries, in close co-operation with planners, and practical measures to ensure the best use of existing facilities. None of these things will be done properly until the traffic specialist is given some power and responsibility, at the planning stage and also in the day-to-day operation and control of traffic, particularly road traffic. So often in the past, no serious effort has been made to define the problem to be solved; traffic measurements have not been made except on an *ad hoc* basis at individual intersections. Also, the present system of giving the powers of decision to lay committees has had a demoralizing effect on those engineers who have studied traffic. Councillors call for professional advice, but frequently reject it when traffic matters are discussed. If it is a question of curing congestion, we are all experts and know the answer without thinking.

Today the outlook is a little brighter. The appointment of Dr. Charlesworth to tackle the 'tune-up' of London streets is most encouraging. Everyone has heard of traffic engineering, some may even think it is more than a fashionable gimmick; and amongst the Local Authorities, there is an increasing awareness of the uses of traffic measurements. But as yet there is no agreement on general principles, nor on the means by which they should be applied. One reason for this is that not enough is known about the relation of building development and the use made of public and private transport, nor of the interplay of traffic between road and rail. In London, although there have been many parking studies, there is practically no information in them on the existing uses of land, or any forecast of likely effects of changes in the use of buildings. Obviously, the number of people coming into central London by bus or train rather than by car, is a factor which affects the amount of parking space needed. Yet there has been no attempt to discover the reasons why some car owners may choose to make particular journeys by public transport. Of course it may be assumed that road congestion stops many from driving themselves and persuades them to use public transport, but it is not known where or how public transport ought to be improved in order to encourage this tendency. In fact, it is doubtful if there is general agreement that this is desirable. For those who acknowledge the necessity for some balance to be struck between public and private transport, the question is, where should the line be drawn? How far should the road system be improved and how far should new urban railways be subsidized?

The Victoria Line

The Report of the London Travel Committee on the Victoria Line emphasizes the lack of data on which a wise decision could be reached even in this limited sphere. The Committee points out that though the Victoria Line may well attract passengers who at present travel by car into central London from the north-east and south, this benefit cannot be illustrated statistically, because the basic data for doing this does not exist. There are no reliable figures for the number of cars that come into central London from the north-east and southern suburbs every day, nor is it known whether travellers who arrive in cars from these areas would personally find travel by the Victoria Line less expensive and more convenient. The Committee also reports, that though ideally the comparison between the Victoria Line and road schemes should be made on an economic basis, they have been unable to do this, since the necessary data for making such a comparison do not exist in the case of roads. The Committee states that a series of Origin and Destination surveys is needed for road traffic, in addition to a survey of rates of traffic increase and of land values. The collection of such data is a difficult and expensive business and perhaps one reason why the task has been shirked is that the practical men think it would take too long. These surveys would call for the development of the Home-Interview sample technique, which has hardly been attempted in this country, except by the political and market research organizations. The analysers would need to make use of computing machines.

Ring Roads No Answer

The commissioning of a preliminary study to explore the practicability and costs of large-scale Origin and Destination studies should be given priority by those responsible for the long-term planning of London's traffic facilities. In the case of the Victoria Line itself, it might fairly be argued that this particular project need not wait for further data to justify it on traffic grounds, because the back-log of road and rail development is now so great.

Until a much greater effort is put into a factual analysis of costs and benefits to the community of alternative long-term schemes, half-informed comment on traffic matters will continue to be an almost daily feature of the newspapers. One much publicised fallacy is that the only solution to London's traffic problems is a ring road, so that through traffic can be kept out of the centre. This idea completely ignores the fact that the largest part of all travel in London is directed at the centre and that motor vehicle journeys are generally quite short. A survey in 1948 showed that two-thirds of central London traffic starts within a 15-mile radius of Charing Cross, and that if a circle of radius 2½ miles is drawn round Charing Cross, 85 per cent of the traffic entering this circle will stop inside it, and only about four per cent will travel more than ten miles. It has been said that if a group of persons was set the problem of designing the layout of a road in such a way that it would be of as little use as possible, in time they would reach the inevitable conclusion, that the road would have to be laid out at right angles to the major flows, in other words, in a circle round the centre.

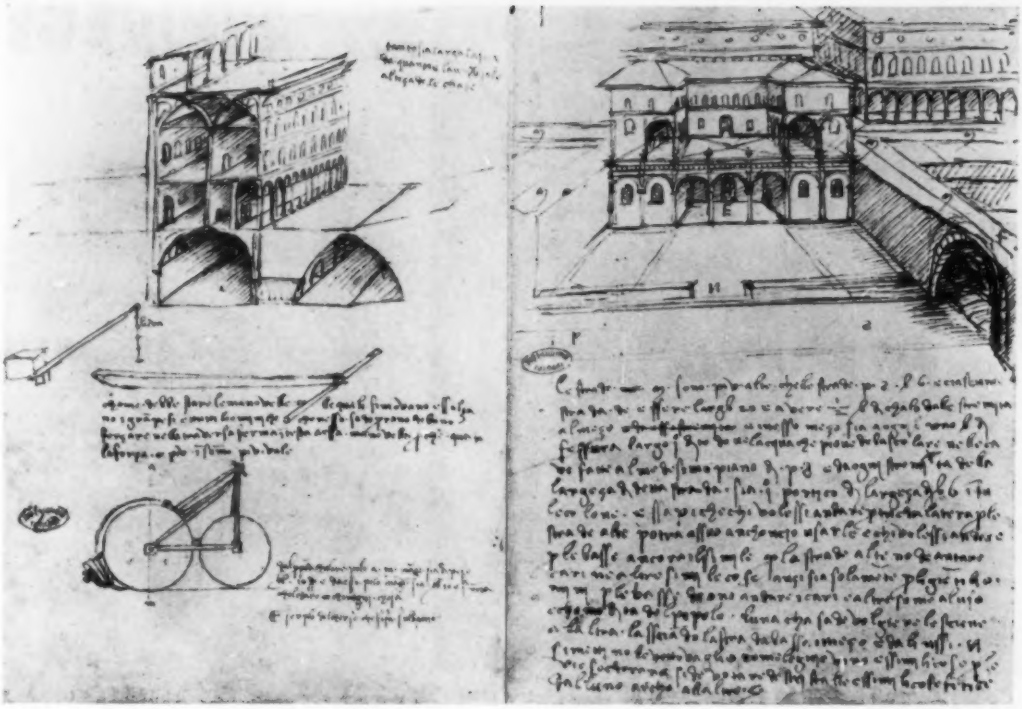
London's centre is very large, and even the smallest ring yet suggested for a new road, the 'A' Ring, would be too far out to act as more than a rather inefficient distributor for radial traffic. With a ring system, the tangle in the centre merely grows worse than before. Magic rings are no answer to the circulation problem in city centres. If roads like the 'A' Ring motorway are ever to be built, they should penetrate as close to the core of the city as possible and run in radially, or tangentially to it with very frequent interchange points with existing streets. This does not mean that they should sever existing development and cut through the city, regardless of the historic grouping of communities. Even today, after so much short-sighted rebuilding since the war, there are still well-defined cleavage lines which could be followed without carving up London on the American pattern. The traffic argument for ring roads is as sensible as the argument Vitruvius used for his ideal town, where the streets were to be oriented to avoid the draughts of eight poisonous winds!

The arguments for urban motorways in London are well-known. Motorways prevent accidents. They also have at least double the traffic capacity of ordinary streets. The first and more sophisticated argument against them is that such roads generate huge volumes of private cars during the crucial peak periods, so that the result is merely to transfer a proportion of the daily migrants from rail to road. Supporters of this view quote American experience, where motorways alone have not cured city congestion. The lesson to be learnt from America is not that there should be no motorways here, but that they must be carefully related, not only to parking projects and modern methods of traffic control, but also to other forms of transport and so to a complete system of orderly development. To succeed in this, far more attention must be paid to the definition and measurement of traffic needs.

The second argument against urban motorways is that they would ruin the appearance of the many still presentable parts of London and would tend to create new slums. But anyone who has looked at Dutch or Swedish examples can see that building on the American scale is not necessarily needed here and that motorways do not have to dominate the urban scene. Perhaps it is the design of much street furniture which makes people think motorways will be hideous and destructive. They inevitably alter the appearance of their surroundings, but it is fair to question whether these changes need necessarily be for the worse. A motorway through an indifferent area may even be the only means of saving some of the finer architectural compositions from the disruptive qualities of motor traffic. The British are the most sentimentally minded of people; and the only breath of criticism heard of a wholesale preservation policy comes, significantly, from the antiquaries. They, at least, are aware of the implications of a policy of indiscriminate preservation. It will certainly spoil the innocent fun of future generations if we lack the self-confidence to give our cities the form which reflects the needs of the age in which we live.

Cost of Urban Motorways

A third argument against urban motorways, or indeed against any major road proposal in London, is the cost. £11 million a mile was a widely quoted figure for the 'A' Ring. If new roads are planned



Leonardo da Vinci's plans for pedestrian precincts, anticipating the Barbican scheme by four centuries.
Photo: Science Museum, London.

intelligently, as part of a long-term improvement and kept away from the present most valuable frontages, (which are the first to go in a conventional widening scheme) then the costs might not be more than perhaps £5 to £6 million a mile. But even if this is a gross underestimate, high capital cost is justifiable, provided it is productive. In road building, it pays to concentrate resources where the gain is greatest, where the traffic is thickest, and to ignore the absolute value of the land so long as its value is increased by more intensive use. The difficulty of putting this argument to the highway authority is, of course, that though they have to find the capital, they are only indirectly beneficiaries from the resulting savings in time, accidents, vehicle-milage and operating costs. This dilemma points to the need for the treatment of urban traffic projects on a less parochial level.

There are signs that urban motorways might in future bring far greater benefits than at present. In America there is widespread interest in automatic vehicle-guidance systems. If these can be made to work, the equivalent of railway operation may be expected on the roads, with the advantages of phenomenal capacity and safety which can be achieved on railways with up-to-date equipment, but without the disadvantages of fixed time-tables and predetermined vehicle-paths.

Pedestrian Segregation

Wheeled traffic is only one component in the traffic plan. The other most important one is the pedestrian. Here it is very doubtful if the usual planning formula, sometimes rudely called the 'Beer Garden' layout, could be made to work on a large scale in London. People simply will not walk any distance to and from bus or car, particularly if they have parcels to carry. Separation of vehicles from pedestrians vertically rather than horizontally is a much more promising scheme. This is not a new idea, it might be described as 'by Corbusier out of Leonardo'; and perhaps now, after 400 years, it will finally catch on.

A pedestrian podium with frequent access by escalator to vehicles at a lower level has obvious attractions, though it is questionable whether the unrivalled view it would give of the surrounding architecture would prove to be one of them. In an ordinary crowded shopping street, little above eye-level is noticed most of the time; but in a strollers' arena, people would have time to look up and then perhaps a new battle of the styles could start in earnest. The possibilities for future improvements for pedestrians as well as for road and rail passengers depend on the results of urgently needed traffic studies being used to work out costs and benefits to the community. They depend also on a far more effective application of planning powers to control land-use and plot ratios to ensure that no large building is put up without enough off-street loading and parking space to swallow the traffic it attracts. Finally, we cannot afford to wait for ever for the ideal solution, before we do something to ease our traffic problems. We badly need some of the Americans' energy and drive and their readiness to try new ideas in practice and to discard them if they fail. There is no doubt that we are not bad at producing new ideas, but very poor at putting them into practice. The pragmatic Americans leave us standing in this field.

PROJECTS ACH
IN RE

LANCASTER BY-P TOR

HOOK R ER-P

THE LANCASTER BY-PASS

The bridge shown above, made of reinforced concrete, carries the newly opened Lancaster By-Pass. The middle deck of this particular bridge has been laid to allow a local farmer to move his cattle easily from one field to another.

A general view of the new Motorway (right). Opened on April 11th by Dr. Charles Hill, Chancellor of the Duchy of Lancaster, the Lancaster By-Pass sweeps northwards from Hampson Green, on A6, to Keer Bridge—11½ miles of dual carriageway. The central reserve is 37ft. wide, to allow for the widening of carriageways from 24 ft. to 36 ft. when it becomes necessary.

ACHIEVEMENTS

N RES

BY-PASS MOTORWAY SIGNS

OK RIVER-PASS

ELECTRIC HEATING UNDER THE ROAD

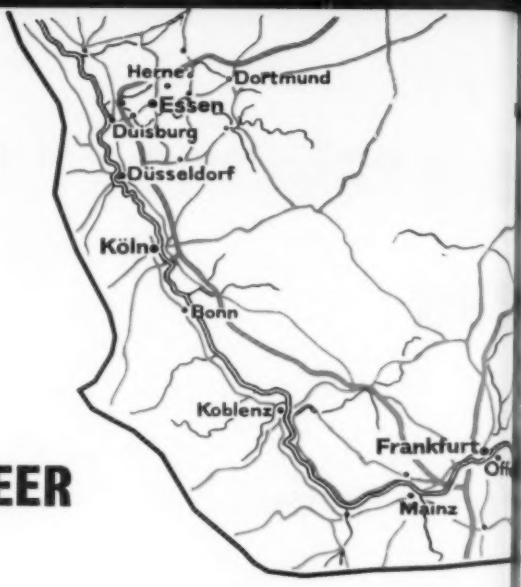
Built into the carriageways of the new underpass at the Ace of Spades, on the Kingston-By-Pass, is an electrically heated grid for de-icing the top surface in cold weather. The layout of the cables can be clearly seen in this photograph.

ENGLAND AND ITALY

These two photographs (above and left) illustrate two different types of directional marking. On the left is a sign on the side of the new motorway near Lancaster and the picture above is a directional sign on the Autostrada del Sole, which runs from Milan to Naples.

Dr. Ing.habil MAX-ERICH FEUCHTINGER

THE ROLE OF THE EUROPEAN TRAFFIC ENGINEER



Western Europe's foremost consultant on traffic engineering, and professor at the Technical University, Stuttgart, describes the European conception of the traffic engineer, the tasks he can undertake and the contribution he can make to traffic planning in Europe. He warns against too narrow an interpretation of his functions and discusses his relationship to highway engineering and town planning. This article is based on a paper given by Dr. Feuchtinger to the Pavings Development Group (Concrete and Soil-Cement) in London, 17th November, 1959.

THE present is indeed an appropriate time for *Traffic Engineering and Control* to be published as it seems that both public opinion and, to an even more significant extent, official circles in Britain have come to see the importance of traffic engineering and to be prepared to make practical use of the benefits that these branches of engineering can give. It is, indeed, not something entirely new to Britain. British engineers in the Traffic and Road Safety Section of the Road Research Laboratory have been engaged for years in excellent research work. But I hope it will not be taken amiss if I say that I have the impression that the practising engineer in Britain has hitherto made too little use of available traffic engineering knowledge, including the results of research carried out in his own country.

Development of Road Traffic

The development of road traffic has undergone a fundamental change in recent years. Traffic had previously been the problem of only a small section of the population, but in these days of steadily increasing motorization it must be regarded as a 'mass' problem affecting every one of us. We now no longer design and build roads for individual vehicles, but for columns of vehicles, for flows of traffic. This is a fundamental difference, and highway engineers and traffic engineers have had to readjust themselves completely. Furthermore, in most countries the number of motor vehicles is growing more rapidly than corresponding road development. No country has achieved even remotely a state of balance between its roads and their traffic. In Britain the divergence between road construction and the growth of traffic has, until quite recently, been particularly serious.

If the degree of motorization is taken into account, there is no country in the whole of Europe in which the improvement of the road system should have been tackled so energetically as in Britain.

The number of private cars—the most important type of vehicle—per thousand inhabitants has increased from 41 in 1950 to 92 in 1959, i.e. it has multiplied 2.25 times. Britain is the second most highly motorized country in Europe after Sweden, and has a figure far above the average for the twelve most highly motorized countries of 66 cars per thousand inhabitants. Taking the number of motor vehicles against the length of the classified roads, we obtain the motor vehicle density, and in this respect Britain with 40 motor vehicles per mile of road ranks first among the twelve European countries, for which the average figure is 27 vehicles per mile. As Britain takes a leading position in the development of motorization up to the present time, the official motorization figure adopted for the design year 1970, namely, 175 per cent of the 1954 figure, must be regarded as too conservative. If the criteria applied in other European countries are applied to Britain, we get the following predictions. For the hitherto adopted design year 1970, the degree of motorization will be 2.6 times that of 1954 and 1.7 times that of 1959; for the design year 1980, which is to be adopted in the future, the degree of motorization will be 2.0 times that of 1959. These are very conservatively estimated figures, which are to be regarded as minimum limiting values. It should, of course, be borne in mind that motorization predictions are not quite the same as traffic predictions. The factors, which may change in the future and play a great part in this connection are the number and the distribution of the population; the number of miles per year travelled by the individual vehicles; the density and direction of the flows of traffic, in so far as congested zones are avoided and new roads give rise to new traffic. This means that accurate predictions of the growth of traffic can be made only for areas of very limited extent and can be based only on regional surveys.

All the same, it is possible to give certain generally valid relationships for the ratio of growth of motoriza-

tion to growth of traffic. For instance, in Germany we have found that traffic outside the urban areas increases more rapidly than does the number of vehicles. From this, and from the shift in the types of vehicles, we have inferred that if the degree of motorization is doubled by 1980, we shall have to reckon with a threefold increase in traffic on our highways. A similar relationship between the growth of motorization and the growth of traffic can also be expected in Britain.

Within the towns, traffic predictions, or 'prognoses', are very difficult to make because of the numerous local influences involved. The size and shape of the town, the density and utilization of the buildings, and the particular features of the network of communications and of the local public transport facilities play an important part. We have found the following relationships to be generally valid for Continental towns:

(1) In the town as a whole, the daytime flow of traffic increases at approximately the same rate as the total number of vehicles;
(2) In the outlying urban areas, motor traffic grows more rapidly, and in the central areas it grows less rapidly, than does the number of vehicles;
(3) In the central area, rush-hour traffic increases at a considerably slower rate than does the number of vehicles because in the zones and at the times of peak traffic density a proportion of the traffic switches to alternative routes and times.

Tools for Traffic Planning

Relationships of this kind can be found only from periodical traffic surveys using scientific methods. Such surveys are essential for making traffic prognoses, and these in turn are of major importance in any traffic planning scheme. For instance, when we in our German towns—excluding the metropolis—carry out a road improvement scheme which is capable of coping with three times the present flow of traffic in the outlying urban areas and twice the present flow in the central areas, such a scheme must involve constructional works on a huge scale. These are, from the economic point of view, very far-reaching and radical operations. Similar considerations apply to Britain where, moreover, the town-planning difficulties are often more serious. Before surrendering to such difficulties, however, the economic side of the problem should be very carefully investigated. No country can now any longer afford to go on planning by purely 'intuitive' methods; every traffic planning scheme should have a solid basis of qualitative and quantitative data.

Nowadays traffic engineering, not only in the U.S.A. but also in Europe, provides a versatile scientific tool for traffic planning based on facts and figures in each individual case. Like highway engineering, traffic engineering is a branch of engineering science calling for expert knowledge and capable of solving in an expert manner the problems with which it is confronted. In Britain, and in other countries of Europe, more and more people are calling for the services of the so-called traffic engineer as if he were a miracle-worker who can make the road users' worries vanish by some kind of magic. But even in professional circles there is as yet, with reference to this fashionable word, by no means a clear and generally accepted conception as to what the professional training of the traffic engineer should comprise and what the scope of his task and his working basis should be.

Development of Traffic Engineering

The concepts 'traffic engineering' and 'traffic engineer' originated in the U.S.A. where traffic problems assumed proportions requiring the application of remedial measures to cope with the vast growth of traffic 25 years earlier than they did in Europe. The high level of present-day traffic engineering in the U.S.A. does not mean to say, however, that we should adopt ready-made American 'recipes' for solving our own problems. Conditions are different. Nevertheless we can learn a great deal from the American methods of investigation and from the way in which the solution of the problems is tackled in that country.

The differences in approach are already evident from the American definition of traffic engineering, which is:

'Traffic engineering is that phase of engineering which deals with the planning and geometric design of streets, highways and abutting lands and with traffic operation thereon as their use is related to the safe, convenient and economic transportation of persons and goods'.

This interpretation has long been very closely adhered to in the U.S.A. The traffic engineer with his specialized training was primarily employed in operational procedures, i.e. for dealing with traffic on existing roads. It is only quite recently that the scope of his work is beginning to widen in the sense that, in conjunction with the highway engineer, he engages in the appropriate planning, design and execution of traffic facilities and also concerns himself with town-planning problems. In addition, he is steadily striving to achieve a higher degree of co-ordination between private and public transport.

The emergence of the combination of highway engineering and traffic engineering skills in one and the same person via the detour of the 'pure' traffic engineer has hitherto been avoided in Europe, despite certain types of approach to the problem, which also appears to exist in Britain. Over the past ten years traffic engineering has in Europe, too, become a branch of engineering of its own. It is, however, generally regarded as forming part of civil engineering and has the purpose of equipping highway engineers with special traffic engineering knowledge. Generally speaking, where training facilities are provided the study of traffic engineering is introduced into the basic professional training of all civil engineers.

In view of the historical development and the present situation, both in America and in Europe, the following fundamental question now also arises with respect to Britain: does the prevailing trend favour the traffic engineer in the sense of the American 'pure' traffic engineering specialist or in the European sense of the highway and traffic engineer? To answer this question it is necessary to examine the scope of the traffic engineer's task.

Tasks of Traffic Engineering

In America the scope of traffic engineering is expressed by the slogan of the 'three Es', as follows:

(1) *Engineering:* the development and improve-

ment of roads from the point of view of traffic, i.e. constructional and operational arrangements, including the provision of control signals to enhance road safety and ease the flow of traffic.

By this means we obtain the properly laid-out road.

(2) *Education:* educating the public in matters of traffic, including the training of the appropriate officials and the necessary propaganda.

By this means we obtain the human being with road sense.

(3) *Enforcement:* supervision of traffic, i.e. the legal measures and police regulations for achieving an orderly flow of traffic.

By this means we obtain the properly operated road.

The first, Engineering, is traffic engineering in the narrower sense and is the most important component. The engineer must start from three fundamental requirements of traffic: safety, capacity, economy. In traffic engineering we now have a scientific tool for the measurement of these fundamental elements with exact criteria. The U.S.A. at an early period carried out extensive researches and investigations into the relationships that exist in traffic engineering. Up to now European engineers have applied these results of American research in a suitably modified form to the different kind of traffic conditions encountered in Europe. But now researches and investigations planned in advance to suit European conditions are taking their place to a large extent. The excellent research work being done in Britain by the Road Research Laboratory is unique of its kind and an example to the rest of Europe. It is the most important basis for developing a tool specifically suited to European conditions, for assessing the three fundamental elements: safety, capacity, economy. In each individual case it is not always easy to achieve an optimum in respect of all three fundamental elements, for increased safety does not necessarily mean increased capacity, and vice versa. Besides this, a good share of intuition is a necessary adjunct to traffic planning technique. These viewpoints are applicable in respect of the construction, maintenance and form of operation of traffic facilities. In each case the engineer's raw materials are the vehicle, the human being, and the carriageway.

The resources of traffic engineering nowadays enable us to find the most suitable solutions not only for individual junctions and sections of road, but also for whole road networks (both urban and regional), and to ascertain their traffic value in qualitative and quantitative terms. The aim of the traffic planning will be determined by the wishes of the road users, i.e. the requirements of the traffic. The starting point must therefore be the traffic survey. The numerous traffic counts that have been carried out in urban and rural districts in recent years have provided us with adequate raw material to detect the relationships to which the traffic behaviour conforms and—with the aid of mathematical statistics, i.e. by making use of the theory of probability—to get generally valid factors with regard to the volume and direction of the traffic.

Car park at Hanover, the subject of the traffic study illustrated on page 38.

From Analysis to Prognosis

Traffic analysis is followed by traffic prognosis, i.e. making a prediction of the traffic as it will be at the target date for the planning—usually some 20-25 years in the future. For this purpose it is essential that the engineer should also concern himself with economic questions and should continually observe the interaction of economy and road traffic, of economic trends and the number of motor vehicles. Very important in this connection is the 'power of attraction' of new roads, which not only attract existing flows of traffic from other roads but also give rise to new traffic which had previously not existed at all. We know very little about this as yet. The construction of motorways in Britain and other countries may afford a suitable opportunity of ascertaining—with the aid of before- and after-studies—the extent of such generated traffic. Similar considerations are applicable to the traffic that will arise in projected new built-up areas, in respect of which the number of journeys made per head and per day by the various means of transport, and in relation to the social structure and other influences, are of considerable interest to us.

Final Stage—Diagnosis

The third stage, traffic diagnosis, provides verification of whether the traffic facilities have been adequately dimensioned. This means that the traffic capacity of the new scheme and the probable flow of traffic it will have to handle are compared with each other. The capacity of a road in relation to the features presented by the carriageway and the traffic using it, i.e. questions of alignment, route selection, type and cross-section of the road, the composition, speed and fluidity of the traffic—brings up new questions and is opening up a wide field of scientific activity. A particularly fascinating feature in this connection is the indispensable combination between observations and measurements on the one hand and theoretical computations on the other. Britain has made some very noteworthy contributions to this section of the subject as well, and it seems worthwhile to compare them with the results obtained in other countries. The object would be to produce something like a European version of the Highway Capacity Manual which would no longer contain the imponderables that occur in the American Manual and would take due account of traffic phenomena peculiar to Europe, e.g. the tramways, the two-wheeler traffic, the different varieties of motor lorries, etc. Figures 1-4 illustrate some stages of a traffic study.

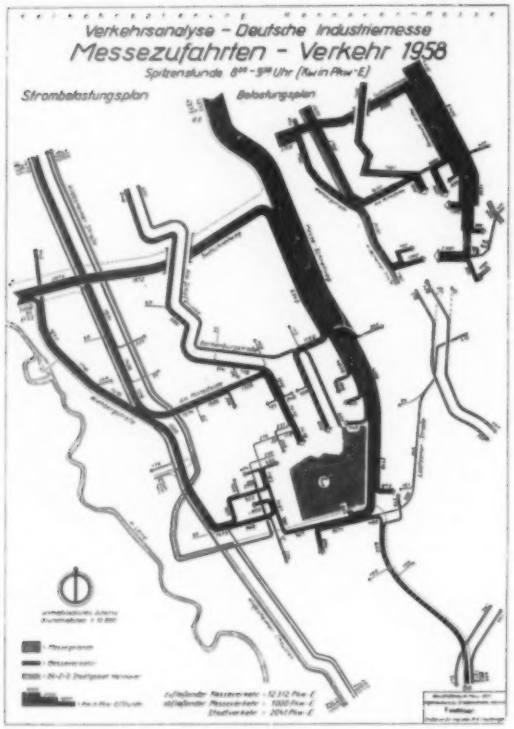
Whereas quite suitable data for practical use, despite these various individual problems, are already available in regard to 'capacity', this is not yet the case with regard to the fundamental element 'safety'. We do not yet know enough about the significance of the accident in traffic engineering, e.g. about the dependence of the relative frequency of accidents on the features of the carriageway and of the traffic, about the relationships between causes of accidents and the condition of the road, and about 'accident prognoses', i.e. the probable degree of safety on projected roads as governed by the type of road and the flow of traffic. There is still considerable scope for research in this field, in which, again, the Road Research Laboratory is doing valuable pioneering work. Over and above general investigations, however, we need recommendations and guiding values for practical use, which will provide fundamental design data as in structural engineering and which will in each individual case enable any particular road scheme to be evaluated in highway engineering terms. So here, too, the necessary link-up between theory and practice, between the general principle and the special case, is still lacking.

Economic Assessment

The third fundamental element, economy, provides information on the ratio of expenditure and effect in road improvement or construction. The American methods of calculation used in what is called the cost-benefit analysis are only to a limited extent suitable for European conditions. Indeed, we have developed our own methods of calculation, e.g. for the loss of time and the consumption of fuel on projected roads, which enable us to select the most suitable of a number of variant designs. These methods are, however, very cumbersome and time-consuming. For practical purposes it is necessary to have simpler test methods which will also take account of other factors, such as vehicle maintanance costs, tyre wear, the costs resulting from accidents, the higher degree of comfort on improved roads, etc. Special research is still needed in this field.

Traffic planning is also a technical-economic task and the engineer has to occupy himself very intensively with economic problems if he wants to have his scheme carried into execution. Traffic facilities must fill a public need. They must therefore fulfil the wishes and requirements of the road users. Therefore the needs of the traffic exercise a marked influence on highway design criteria: alignment, design speed, capacity, classification of the road, cross-sectional arrangement, forms of junctions, etc. In particular, the dynamic movements and the steering properties of the vehicles will determine the geometric design of the road. The mechanics and the geometry of motoring require from the design engineer a knowledge of the pertinent physical principles. From this the interlocking of the problems of highway engineering with those of traffic engineering will be apparent. I only mention the numerous optical influences to which the motorist is subjected on the roads by day and at night. Then there are the influences of the friction between vehicle and carriageway, of the smoothness and brightness of the carriageway surfacings, and of the design of civil engineering structures such as bridges and tunnels with a view to obtaining good traffic-flow conditions, together with the particular problems of cross-sectional design of the road, the safe-guarding of load-bearing parts of structures from collision with vehicles accidentally leaving the carriageway, bridge handrails, lighting, maintenance and winter services without interference with the traffic, the heating of carriageways on bridges, etc. There are the numerous other guard and safety devices at the edges of the carriageway on high embankments and in curves, not to mention the carriageway markings.

These few examples will have served to show why in my country, where the so-called traffic engineer is already to be found in the employ of numerous public authorities and institutions, we have



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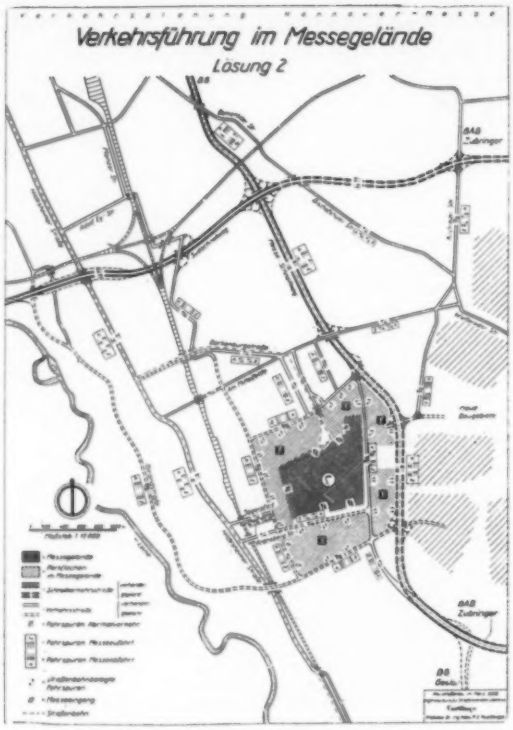

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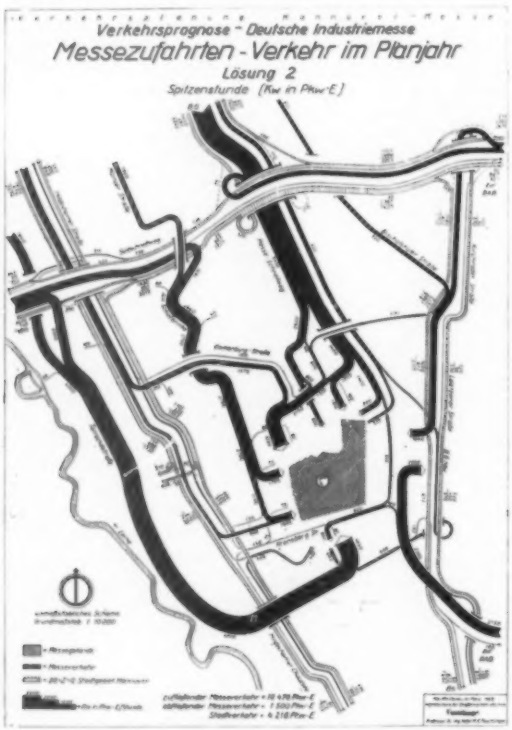

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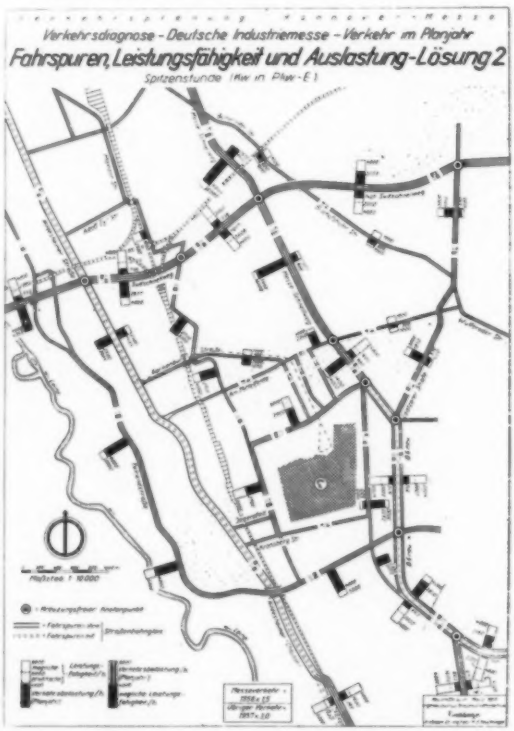
Verkehrsdiagnose – Deutsche Industriemesse – Verkehr im Planjahr
Fahrspuren, Leistungsfähigkeit und Auslastung – Lösung 2
Spitzenstunde (Kw in Pkw-E)

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These figures show as an example parts of a Traffic Study of the roads traffic leading to the exhibition area in Hanover. The question was, how the 20,000 parking-lots today (page 36) could be widened to 40,000 parking-lots in the future and how in relation to this, the capacity of the access-roads could be increased. Fig. 1 shows the traffic analysis, that means the peak-hour traffic streams driving towards the exhibition area during the industrial exhibition in 1958. In Fig. 2 the planned road network is drawn in connection with the parking lots. Fig. 3 shows the traffic prognosis for the planned road network with the predicted traffic of 1980, and Fig. 4 shows the result of the traffic diagnosis, that means the comparison between the capacity of the planned road network and the estimated traffic volume of 1980.

not confined his professional training to a narrowly specialized field with the object of turning him into a 'pure' traffic engineer whose services we engage only in connection with the operation of existing roads. We believe, rather, that we need the highway and traffic engineer who is primarily a civil engineer and who has as sound a knowledge of the constructional side of road-building as of the traffic engineering side. Of course, some engineers will tend to concentrate more on the constructional, and others more on the operational side of their work. In our opinion, the unity of construction and operation should, however, be preserved fundamentally in the same way as has been done in the case of those great means of transport, the railways and the waterways.

Highway and Traffic Engineering Problems

In highly motorized countries it is no longer sufficient for future needs merely to go on improving the existing roads. Both for inter-urban and for urban traffic it is necessary to create new road space intended exclusively for the use of motor vehicles. For inter-urban traffic this is provided by the motorways, and for urban traffic it is provided by the expressways free from frontage access and crossings on the level. When I had the opportunity of seeing from the air how rapidly a motorway could be built in Britain, I also saw that the impressive new motorway approaching London from the north-west stops short just where the traffic begins to swell to a tremendous flow, namely, on the outskirts of London. This is quite staggering. The vast majority of the cars using the London-Birmingham motorway will in all probability be starting from, or heading for, London. Hence the construction of the cross-country motorway can constitute a significant advance only if the construction of the appropriate urban motorways were undertaken at the same time.

It is obvious the construction of these urban motorways, which may have to be elevated roadways, involves the expenditure of huge sums of money and brings about a revolutionary transformation in the appearance of the towns. This gives rise to traffic engineering problems of vast magnitude, and this branch of engineering must therefore improve and increase the tools it employs. Fortunately, we have meanwhile found some suitable opportunities for doing so in Germany, inasmuch as a number of schemes for urban expressways are under construction. It is to be hoped that the inter-urban motorways in Britain will also initiate the construction of new road systems in the towns as well. British roads are indeed noted for the excellent condition of their surfacings—but they are equally noted for the low speeds that can be attained on them. In particular, this is true of the urban roads. The losses of time due to traffic jams and the slow movement of traffic during rush hours impose tremendous financial burdens on the national economy. In addition, there is a rapidly growing shortage of parking space, which is beginning to become the No. 1 traffic problem.

The need for applying radical constructional measures in the towns with the object of achieving multi-level routing of urban traffic calls for drastic steps in dealing with the existing buildings. In preparing traffic schemes involving large areas the planning engineer must make them fit in with the regional and national planning schemes; similarly, in preparing urban traffic schemes, he must duly take the town development plan into consideration. It is sometimes debated which of the two spheres of activity—town planning or traffic planning—should take priority over the other. This is a pointless question because urban traffic planning is a part of town planning and can only be viewed and tackled in conjunction with it. The starting point of the task of restoring healthy traffic conditions in our towns and cities lies in sound town planning, because this determines the sources of traffic. The mistakes of bad town planning in respect of traffic requirements, cannot be put right completely by the engineer with the means at his disposal, however refined and highly developed the traffic engineering technique employed may be. In this respect it would be a most welcome state of affairs if the town planner and the traffic planner could get together as equal partners at the outset in dealing with any planning work that arises in a town. If, on the other hand, they work independently of each other or, indeed, in opposition to each other, then this can only harm the interests of the towns that are so urgently in need of reorganization and improvement.

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Benefits gained from TRAFFIC ENGINEERING RESEARCH

by G. Charlesworth, B.Sc., Ph.D., F.Inst.P.

Dr. Charlesworth, who earlier this year was released from the Road Research Laboratory to become Director of the London Traffic Management Unit, gives examples of the application of results of research to improvement of traffic flow.

THE traffic congestion on the roads of this country is serious. The delays are frustrating to all drivers and are a serious economic loss to the country, estimated to amount to some £250 million per year exclusive of losses of non-working time. But what is even more serious is that the numbers of vehicles on the roads are increasing, the amount of traffic is increasing and this increase is far greater than the increase in mileage of road or in road capacity. This position is likely to continue for an indefinite period, for in large areas of this country the land is required for other purposes, such as houses, factories, agriculture: moreover, in the big cities and towns it would be necessary to demolish large areas of buildings in order to increase the road capacity. The road building cannot therefore keep pace with the traffic and other measures must be found for combatting the peril.

Many measures have been suggested for helping to increase the speed and flow of traffic. Some of these are good, some are of little value. It has become more and more apparent that in order to bring in measures that are valuable they must be based on scientific facts; opinions in themselves are of little value. It is necessary to know a great deal about the relation between, for example, speed, flow and width of road, before deciding where and how wide to build a new road, or make modifications to an existing one. Again, it is obvious to all those who deal with traffic problems that numerous alterations are needed. But it has to be decided which of these many alterations should have priority and this calls for facts which should not only be fully known but should also be scientifically interpreted.

During the last few years, some of the guiding principles have been obtained and can now be applied. Many more, however, await the time and the ability of research workers and practising engineers. A few examples from the work of the Road Research Laboratory will serve to illustrate the application of some of these principles of traffic engineering.

Traffic Surveys in City Centres

One of the earliest studies in traffic engineering undertaken at the Road Research Laboratory concerned city traffic. It was found that practically nothing was known about traffic flows, speeds and

TABLE 1

Traffic conditions in central areas of cities—weekdays

	London 1958 (9.30-5.0)	Glasgow 1956 (8.30-6.0)	Edinburgh 1957 (9.0-5.30)
Mean total flow (vehicles/h.)	1,600	880	900
Mean journey speed (mile/h.)	10.1	8.2	14.3
Mean running speed (mile/h.)	15.9	12.8	16.4
Stopped time			
Journey time (per cent)	35	36	15
Mean width of carriageway (ft.)	41	39	51
Controlled intersections per mile	5	7	3

delays. A moving observer technique was devised[1] by the laboratory and a number of surveys of traffic have been made in the centres of London, Glasgow and Edinburgh. These surveys provide data on flows, speeds and delays on the streets covered and also, as a result of periodic surveys, an indication of trends in these quantities. Some comparative results are given in TABLE 1. These show that although the streets in Central Glasgow are about the same width as those in London, the London streets will carry much more traffic at a higher speed than those in Glasgow. The same average flow is carried in Glasgow as in Edinburgh but at a much lower speed. The Glasgow streets however, are narrower and have many more controlled intersections per mile.

From the surveys made in London it has been estimated that during the daytime on weekdays, flows on the routes studied have been increasing at about 2½ per cent per annum since the end of 1947, and speeds have been decreasing. The proportion of journey time spent stopped in London and Glasgow points to the need for improvements to intersections if traffic is to be speeded up. In addition to making studies during the day, studies have also been made in the peak hour in London and in 1958 it was found that journey speeds in the peak hour were about 18 per cent slower than in the daytime, while the peak-hour flow had increased by about 17 per cent. Much of this increase in journey time was due to the increase in the time spent stopped at intersections, which was approximately 50 per cent greater than during the daytime hours. The evening survey also indicated that the flow in a number of streets in the peak was tidal in character, and it is possible that on these streets the principle of 'off-centre lane movement' might be used to advantage.

Value of O-D Surveys

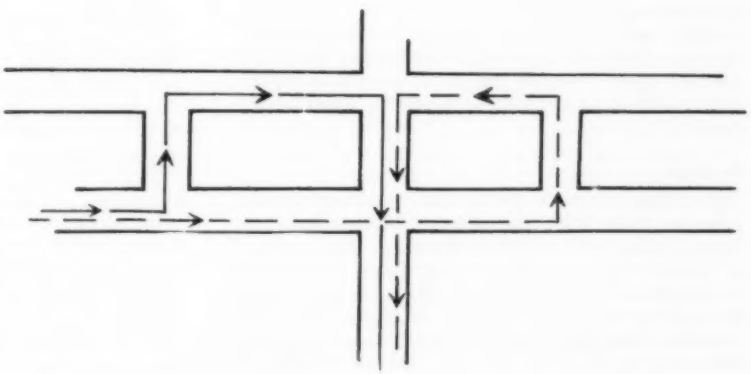
Surveys of the kind just mentioned are useful in indicating what conditions are like on the streets and where improvements of various kinds might be investigated. They do not, however, show which of several alternative improvements to circulation might be the best. For this kind of work more extensive surveys of the origin-and-destination type are required and, although such surveys may become expensive in the case of large towns, they are a necessary prerequisite to planning roads on a factual basis. Much work has been carried out in the United States of America and to some extent in Great Britain on ways of making these surveys, and electronic computers are being used in the U.S.A. to help speed up the analysis involved.

The Road Research Laboratory has recently had the opportunity of taking part in a survey in a medium-sized town and of assessing the relative merits from a traffic point of view of alternative proposals for new roads. In the analysis it was assumed that drivers would choose a route giving the shortest journey time and that drivers were of two classes—those who were prepared to use all roads making up the network and those who would use only main roads. It was found that if 70 per cent of the traffic was assumed to use all the roads and 30 per cent to use only main roads, then the method of allocating traffic to the existing road network on the basis of journey times, gave results in reasonable agreement with actual observations of traffic flow during the survey period.

Signal-controlled Intersections

A considerable amount of research[2] has been made into the calculation of delays at signal-controlled intersections and the results can be used to estimate numerically the merits of different methods of control. One of the possible applications of the results of these calculations has already been published.[3] Two suggestions were put forward for easing traffic conditions at a heavily congested urban intersection where there was a heavy right-turning movement from west to south, as shown below. Calculations were made of the principal effects on delay and journey time of the alternatives by using the results of the delay calculations and by making assumptions about journey speed on the diverted route. It was concluded that at present traffic levels with scheme A there would be a reduction of 20 per cent in the journey time of all vehicles at the expense of an increase of about 150,000 vehicle-miles per year and that this scheme would provide an increase of 14 per cent in the capacity of the intersection. With scheme B journey times would be increased by about 10 per cent and there would be an increase of about 300,000 vehicle-miles per year; the capacity of the intersection would be increased by about 7 per cent.

An opportunity to investigate the value of linked traffic signals to regulate the speed of traffic was provided during the Slough Experiment of the Ministry of Transport.[4] A system of 11 fixed-time signals was installed along the 2.2 mile long section



Alternative schemes for eliminating right hand turn from which calculations were made to ascertain higher capacity.

of A.4 in front of the Slough Trading Estate. The signals were set to produce a speed of progression in each direction of between 25 and 30 mile/hour depending upon the time of day. Before the signals were installed the carriageway was widened from 30 to 40 ft. over part of its length and certain improvements were made to the street lighting; the road widenings were necessary to allow sufficient peak-hour capacity at the signals. Following the installation of the signals, serious casualties at the junctions fell from an expected average of nearly ten to just over one per year and the serious casualties between junctions were halved. It was estimated that the total number of serious casualties was reduced by about 70 per cent. Journey times were about a minute longer after the signals had been installed and the average journey speed of private cars fell from 31 to 25 mile/hour during the day and from 33 to 26 mile/hour at night. It was concluded from this experiment that the linked fixed-time signals had effectively controlled speeds and their installation was followed by a substantial reduction in the serious accident rate, the reduction being greater by night than by day.

Carriageway Markings

Carriageway markings are a valuable tool in the hands of the traffic engineer. It has been found for instance that lane markings at traffic signals can increase the capacity of the signals by marshalling traffic into lanes, and lane markings of various forms are used to regulate the flow in rural areas. Carriageway markings can also be used at other than signal-controlled junctions and one such instance that has been investigated by the Road Research Laboratory is the use of the word 'HALT' painted on the carriageway to supplement the normal 'Halt Major Road Ahead' sign. Investigations were made at five junctions before and after painting 'HALT' on the carriageway and it was found that the proportion of drivers who stopped at the sign increased on the average from 64 to 81 per cent, when 4-ft. high letters were used; the use of 2-ft. high letters had a negligible effect. It was suggested that this effect might have been due to the novelty of the marking and investigations were therefore made of behaviour at a selection of junctions in areas where 'HALT' or 'STOP' had been used on the carriageway for many years and at junctions in neighbouring counties where the carriageway marking had not been used. It was found that at the junctions with 'HALT' on the carriageway, an extra 7 per cent of drivers made some effort to conform to the requirements of the sign. An investigation was then made of accidents at these same junctions and it was found that the average personal-injury accident rate of accident involving vehicles on different roads was 40 per cent less at sites with carriageway markings than at those without the marking.

Parking

One of the major problems with which the traffic engineer has to deal is that of street parking. Recently attempts have been made to regulate parking in parts of London by means of parking meters and a few investigations have been made of the effect of meters installed in north-west Mayfair, in July, 1958. The number of standing vehicles in the controlled zone decreased by about 50 per cent, but the amount of parking in neighbouring zones to the west and to the north increased, although it was not possible to determine whether the vehicles in these areas were those displaced from the metered zone. Within the metered zone the average speed of traffic increased by 9 per cent to about 10 mile/hour. In streets just outside the metered zone speeds fell. The time taken to make visits to a number of addresses within and outside the metered zone was measured and it was found that within the metered zone the average time required for visits to five addresses fell by 10 per cent, but the time required for visits to nine addresses in the surrounding area increased by 29 per cent.

Some observations were made during December, 1959, of parking in the 19 special car parks organized as part of the 'Pink Zone' plan in London. The special car parks were set up at varying distances from the centre of London, ranging as far west as Wormwood Scrubs and as far south as Clapham Common. It was estimated that on the average the maximum number of vehicles in the parks during the day was about 1,500. More than 90 per cent of the vehicles were contained within the four parking places in the Royal Parks and on Horse Guards Parade and the remaining 14 car parks were relatively little used, those farthest from the 'Pink Zone' being used least of all.

Conclusion

In this short article it has only been possible to illustrate a few of the ways in which traffic engineering principles can be applied in practice. It is perhaps evident from what has been said that traffic engineering is based on facts and it is certain that more facts are required both by the research worker and by the practising traffic engineer. It is necessary also that there should be more dissemination of information about traffic engineering matters amongst those concerned with the subject. Two principal ways in which this can be achieved are by discussions, such as are arranged by the Traffic Engineering Study Group set up by the *Institution of Civil Engineers*, and by publications such as this new journal.

Acknowledgement

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The Wolfe Award

Dr. F. V. Webster, a physicist at the Road Research Laboratory has been awarded the Wolfe Award for 1959 for research that has covered the general settings of traffic signals which is part of a continuous programme of research into the capacity, delay and safety at road intersections. It has resulted in development of a signal controller, designed to ensure that once a vehicle has passed the point at which it can no longer stop in safety, the green light will remain until the vehicle has safely passed the intersection.

PARKING PROBLEMS

Extracts from the Informal Discussion on Parking at a Meeting of the Traffic Study Group of the Institution of Civil Engineers on March 29th, 1960, opened by

Rowland Nicholas, C.B.E., B.Sc., M.I.C.E.,
City Engineer, Manchester

THE parking problem in business and shopping centres has arisen largely from the great increase since the war in the use of the motor-car for business and shopping purposes and as a means of transport between home and work.

The problem as it affects the prosperity of an urban area, is the elimination of the long-term parker from the streets in the business and shopping areas so that there may be sufficient kerbside accommodation in streets, where parking can be allowed, always available for the short-term parker who may thus be enabled to undertake his commercial duties or be encouraged to make use of the shopping and other facilities. The prosperity of business and shopping areas may more and more depend on the availability of parking space for those making business and shopping calls. It may also be affected by the difficulties experienced in loading and unloading goods from commercial vehicles in streets where parking is intense. Unless these facilities are available, urban centres may disintegrate under the pressure of the increasing use of private vehicles, as is happening in some of the larger American cities.

Statutory Provisions

Legislation is contained in the Road Traffic Act, 1956, enabling local authorities (with certain exceptions) to prohibit or restrict the waiting of vehicles in streets. These Orders may be divided into:—

(*a*) Orders restricting waiting (except for the loading or unloading of goods) during specified periods and times or to a specific period of time, for example, one hour in any two.
(*b*) Orders prohibiting waiting on alternate sides of the street on alternate days.
(*c*) Orders prohibiting or restricting the loading and unloading of vehicles.

A kind of controlled street parking scheme could be attained by elaborate use of a combination of these Orders, but enforcement would require the use of a large number of police officers.

The only practicable system of parking control for which legislation is available in this country, is the parking meter system. The use of parking meters restricts street parking within business hours to a specific parking time. This use of the streets by short-term parkers enables calls of short duration in business and shopping areas to be made conveniently from nearby street parks in which there is a regular vacating of spaces. People desiring to park for more than say two hours must be provided with other facilities, usually in off-street car parks. It seems reasonable that the long-term parker should suffer any inconvenience due to the use of more distant parking locations because in most cases this will only happen at each end of the working day. Moreover, if this inconvenience should be unacceptable, the prosperity of the business or shopping area would not be greatly affected and no doubt other means of transport to work would be used.

Designation of Street Parking Areas

Under the Road Traffic Act, 1956, the Minister of Transport may only designate metered parking places on highways in the Metropolitan Police District or the City of London. For the designation of such parking places outside these areas, it is necessary for the Minister of Transport or in the case of Scotland for the Secretary of State, to place an Order before both Houses of Parliament and it requires the approval of both Houses.

Parking Surveys

The nature and the extent of the parking problem can be determined by recording at frequent intervals the registration number of each vehicle parked in each street of an area somewhat greater than that with which the scheme is intended to deal. Information should also be obtained about the parking times of vehicles in public and private car parks. It is also necessary to know the maximum number of vehicles waiting for the purpose of loading and unloading of goods at any one time. The next step is to ascertain the street parking capacity, which in effect necessitates the preparation of a 'Working Plan'. This Plan will show any existing parking restrictions, the proposed parking places divided off to show the individual parking bays and the gaps for the loading and unloading of vehicles, strips within which parking of any kind should be prohibited, motor-cycle parking areas, taxi ranks, existing and proposed one-way streets and the location of traffic signal installations.

Parking meters guarantee the use of parking space and therefore they should not be installed in streets where the carriageway is very narrow. Some parking may take place now, but without meters this can be dealt with by the police wherever obstruction is caused. In the parking scheme 'No Waiting' Orders would be applied to such streets together with all other streets on which parking is not to be permitted. In this way, all street parking in the parking zone, other than for the loading and unloading of goods and the free parking of motor-cycles, would be controlled by parking meters. The omission from the parking scheme of narrow streets and the provision in the scheme for proper facilities for loading and unloading and for the prevention of parking near junctions will mean that usually the estimated parking capacity will be substantially less than that which obtained while parking was not controlled. On the other hand, the difficulties which arise with uncontrolled parking will no longer arise and the

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aggregate cost of the delays caused by indiscriminate street parking will have been largely eliminated. Comparison of the parking spaces which can be made available on the streets with the requirements found by the parking survey should enable suitable boundaries for a controlled parking zone to be defined.

Off-Street Parking

The number of long-term parkers having been estimated from the parking survey, the off-street parking requirements can be met by the capacity available in any existing car parks, by surface car parks and by the provision of multi-storey garages or underground garages and of course by the provision of public car parking space in new commercial buildings.

Basically, the location of off-street car parks will be influenced by the following factors:—

(*a*) nearness to places of work
(*b*) adequacy of approach traffic routes
(*c*) availability of sites with dimensions which will provide economic parking arrangements.

Schemes have been envisaged for locating car parks outside commercial and shopping areas in positions from which journeys can be completed by public transport. It should be remembered however that many people use their private cars for travelling to and from work because it protects them from inclement weather, avoids the possibility of queuing and waiting and of travelling in overcrowded conditions. Consequently, any off-street parking proposal which involves the possibility of these conditions arising is not likely to be attractive. It is however possible that the location of car parks at the suburban stations of electrified railways having frequent rush hour services to conveniently placed stations may be attractive especially where the rush hour road conditions are particularly difficult.

Types and Costs

Where a number of off-street car parks are envisaged they should be distributed so that they may be conveniently available to traffic on the main radial roads and it is important that car parks should be so designed that they fill and empty rapidly without creating congestion in the adjoining streets at rush hours. With this in view, multi-storey car parks should preferably have a capacity not exceeding about 600 cars.

Off-street car parks could either be of the ramped or mechanical type. In the case of ramped garages, practical experience has shown that these should not exceed five storeys in height above ground level. Economies in capital and running costs can be achieved by adopting an unheated and unclad form of building which would obviate the need for sprinklers and reduce the amount of artificial lighting required. Recent estimates have shown that the capital cost of a simplified building of this kind might be of the order of £300 per car space.

The inclusion of petrol sales, greasing, washing and minor repair facilities together with showroom space, will help to reduce the parking charges. Indeed, it may be found possible to further reduce the charges where sites are located in commercial areas by adopting some form of composite development, possibly with garaging in the basement and lower floors with a flat slab office block above approached by a lift system from a ground level foyer, the lift shafts passing through the garage floors. In such a development the commercial value of the site might be largely recovered by the office development, leaving the garage charges to finance the cost of the garage structure only and of course maintenance and running costs.

The Act of 1956 provides that the profits from parking meters may only be used to meet losses on the parking meter accounts in previous years and for the provision of off-street parking facilities.

Designation of Parking Places

An application to the Minister for the actual designation of parking places on the street must include a plan defining the overall length of the parking place in each street or section of street and also the adjoining footway on which the parking meters will be placed, indicating in respect of each parking place the number of parking bays and the total length within the place not to be occupied by parking bays.

The preparation of this information requires detailed consideration of each street in the proposed parking area. Business undertakings should be contacted to ascertain and check their loading and unloading requirements and the help of the local Chambers of Commerce and of Trade should be sought in order that detailed problems may be discussed and the aims of the proposals fully understood by the firms who will be affected in one way or another. The application should also indicate the charges which are to be made for the use of the parking bays and the times when they may be used.

The Parking Meters (Description and Testing) (England and Wales) Order, 1957, defines in some detail the types of meter which may be installed, how and when the meters are to be tested and the manner in which records of these operations are to be kept.

The Disc System

Regulations limiting the duration of parking time were imposed in 1953 in an area of central Paris known as the 'Blue Zone'. The traffic regulations which were similar to those referred to earlier had been of little avail, mainly because of the difficulty of enforcing waiting restrictions.

By the disc system, the motorist is required when he parks his car between certain hours of the day, to display behind the windscreen a parking control disc. This cardboard disc is so devised that when the motorist sets his time of arrival on the slit on the left hand side of the disc, the time by which he is required to depart is automatically shown in red figures on the right hand side and is visible from outside the car.

It is important to realize that this system does not constitute any means of defining or controlling the location of areas in which cars may or may not park. Therefore with a substantial amount of police control the system is effective in removing the long-term parker from the area but makes no provision for the reservation of kerbside space for the loading and unloading of goods vehicles nor does it provide any income which can be used to reduce the cost of off-street parking for long-term parkers.

The parking meter system seems to be the only one to provide a means whereby street parking is fully controlled and in a manner requiring the short-term parkers to share the overall costs of providing satisfactory car parking for all car users.

DISCUSSION POINTS

In accordance with the Institution's procedure, names of speakers in its discussions are not published, but the following is a brief summary of some points raised.

Meter Experience

Having been responsible for the first parking meter scheme in this country one speaker warned about the results which might be deduced from a parking survey. If there was already a saturation of parked vehicles in the streets, the survey would give no indication of the unsatisfied demand for short-term parking. The short-term parker was usually crowded out by the long-term parker and the survey did not show how many short-term parkers would want to come to the area if there was room. Further, the survey showed the demand for free long-term parking on the streets, but gave no indication of what it would be if the motorist had to pay. Those wanting to park all day for nothing might be greatly in excess of the number prepared to pay.

He stated that two plans were of use in addition to the statutory plan. One, the working plan which was prepared as the result of a survey which was of the greatest use not only in preparing a scheme but to any engineer who had to appear at a public inquiry. The other was the detailed plan. When a scheme was submitted to the Minister there had to be submitted with it the statutory plan which merely indicated the parking space but not loading gaps. A more detailed plan, which had no statutory significance but indicating the intentions of the authority could lead to a reduction in objections because it showed the location of each parking meter and loading bay.

The speaker contended that the continuing increase in vehicles might result not only in an overall increase in the number of long-term parkers, but also lead to an increase in the number of people who wanted to visit central areas and park for a short time. The charge made in parking meter schemes should therefore not be fixed for all time but adjusted to demand. It would be fatal if all the parking bays were occupied all the time, and therefore it might unfortunately be necessary to adjust the price to ensure that the demand was always somewhat less than the number of metered spaces.

Threat to Public Transport

Another speaker said that the difficulty was to devise a solution of the parking problem without harming public transport. In London at peak hours only about six per cent of the total coming into the central area came by car and averaged slightly less than 1½ persons per car, the other 93 per cent used public transport systems.

An obligation was imposed in London on building promoters to provide garage space and he estimated that car spaces were being provided in new buildings at a yearly rate of about 4,000. There were about 8,000 parking spaces in public garages, but more were needed and there still remained a considerable demand in London for long-term parking space. So far, although there were some interesting signs of such buildings being provided by private enterprise, enough had not yet been provided. The reason was economic. If the private developer was expected to do this, the charges must be such as to ensure the reasonable possibility of a fair profit on the capital involved but these were likely to be high, particularly in the middle of cities such as London and Manchester.

Mr. Nicholas's view was that authorities would be forced to cater for the motor car, which was becoming a part of our life. That did not mean that we should destroy our cities; it was possible to do a great deal without anything like that happening. Mr. Nicholas had no great sympathy with public transport systems which should make every effort to meet the competition of the private car. Regarding charges, 3s. 6d. should be satisfactory in Manchester. The use of the profits on parking meters to provide off-street parking did not mean that the local authority had to put up the buildings and run them. He had been advised that it would be in order to charge against their parking meter account any difference in the value of a site which might arise because instead of using it for its most lucrative purpose, for example as an office block, it was used for off-street parking. The sites would be leased, and the difference between the value in the open market and the value as a parking place would be shown in the parking meter account as an expense.

Paris Discs

Speaking of the Paris disc system, a speaker claimed it had now settled down and was meeting the cost of supervision from fines imposed, which were regarded as equivalent to the extra charge for overstaying the period. There was no need slavishly to copy what had been done there. Loading bays could be reserved on the kerbside and legislation could allow the fines imposed to be used to cover the cost of the scheme. Another speaker said that the Paris 'blue zone' accommodated some 6,000 cars, and in the month of December, 1958, well over 100,000 infringements had been reported in that area. In a full year about 1,000,000 infringements were reported, and he understood that the revenue obtained from the fines mounted to something of the order of £500,000 a year.

Mr. Nicholas replying to a speaker who had asked why the short-term parker should help to finance off-street parking, said it might equally be asked why the short-term parker should be allowed to park in the street if the long-term parker was denied that right. If the Paris system paid for itself, it must be because there was so much disregard for the regulations that the fines covered the cost of the considerable police force needed to operate the system.

Parking by Shoppers

Another contributor stated that in Central London, parking was increasing at about eight per cent per annum, about the same as the increase in traffic. In the Mayfair area parking had decreased with the installation of parking meters. The position was made worse by shopping, which was one of the commonest reasons for short-term parking. Much of the shopping demand for parking was peaky. Over 30 per cent of the shoppers using cars in Central London did their shopping between 2 and 6 p.m. on Saturday afternoons which was difficult to meet. Traffic engineers would have to educate the public to spread their shopping hours. The problem was essentially the same as that of rush-hour travel.

Mr. Nicholas pointed out that there was a very considerable drop in other business traffic on Saturday afternoons, and in Manchester it had been found that this helped to make more parking space available for shoppers.

Another speaker said that in central London the average amount of on-street parking at busier periods doubled between 1951 and 1959, although the vehicle mileage increased by only half the amount. The increase in the amount of parking was of the same order as the increase in the ownership of vehicles. After installation of meters in Westminster parking had fallen by about 50 per cent and speeds through the area had increased to the same extent. Parking meters cut down the average duration of parking but also the number of parking sites, and it was an interesting question whether the amount of parking in the area was increased or decreased by the introduction of parking meters.

Basement Car Parks

Another speaker said he thought that the right way of tackling the problem was that adopted by the London County Council, who required new office buildings to provide a certain amount of space for car parking in the basements. He felt that this should be carried further and that in these basements some provision should be made for the public to park their cars, with an indication of whether the garage was full or not. In that way it might be possible to provide dispersed parking and so avoid creating additional traffic problems. Some provision could be made to compensate the developer for providing this additional space.

LIGHTING SECTION

EFFECTS OF LIGHTING ON FLOW AND SAFETY

by Granville Berry, M.I.C.E., M.I.Mun.E.,
City Engineer, Coventry

IN the post war years there has been an ever increasing awareness of the important contribution that street lighting is making to the solution of road traffic and safety problems in many countries, and Codes of Practice governing the design of lighting installations now exist in more than a dozen European countries in addition to Great Britain and the U.S.A.

During the last few years, while road traffic has been growing rapidly, it has become apparent that night traffic is no longer purely a winter problem, but is one that affects eight or nine months of the year, and this new factor must be taken into account in designing our roads so that they can be safe by night as well as by day.

To provide a road with lighting today it is not sufficient merely to add a few lamps when roadworks are nearing completion; the lighting installation must be designed as an integral part of the road itself, after taking into account the effect it is likely to have on speed and traffic capacity, and the type of road surfacing to be adopted. It is equally necessary, when considering short term improvement works for relieving congestion and speeding up the flow of traffic on existing roads, that full regard be given to the effect of improved lighting both on peak hour flows and on accidents involving personal injury.

Development of Modern Lighting

Prior to World War I it was generally sufficient to provide odd lamps for security reasons and to serve as warning lights at dangerous bends and crossings, but with the rise of motor traffic it became necessary to provide more continuous lighting in streets so as to give adequate illumination for the safe movement both of pedestrians and motor vehicles. The development in the early 1930s of new types of light sources —sodium and mercury vapour discharge lamps (which have high efficiency and long life)—made it economically possible to provide the higher standards of lighting needed.

Since the end of World War II the fluorescent lamp has been developed with a life of 5,000 hours (compared with 1,000 hours for filament lamps) and further technical improvements have taken place with both mercury and sodium lamps, culminating in the introduction last year of the high wattage linear sodium lamps which have opened up new possibilities for the lighting of fast traffic routes. Also since 1945 the British Standard Code of Practice for Street Lighting, largely based on the Ministry of Transport *Departmental Committee's Report* (1937) has been issued and is now largely governing all new lighting installations in this country. The Code, which is in two parts, deals with the lighting of 'Traffic Routes' and 'Other Roads' and was designed to facilitate traffic flow mainly in urban streets and the rapid increase in traffic and the construction of fast motorways, flyovers, etc. is bringing new problems which can only be met by the provision of higher levels of illumination and a revision of the Code is already in hand.

Research into Lighting Problems

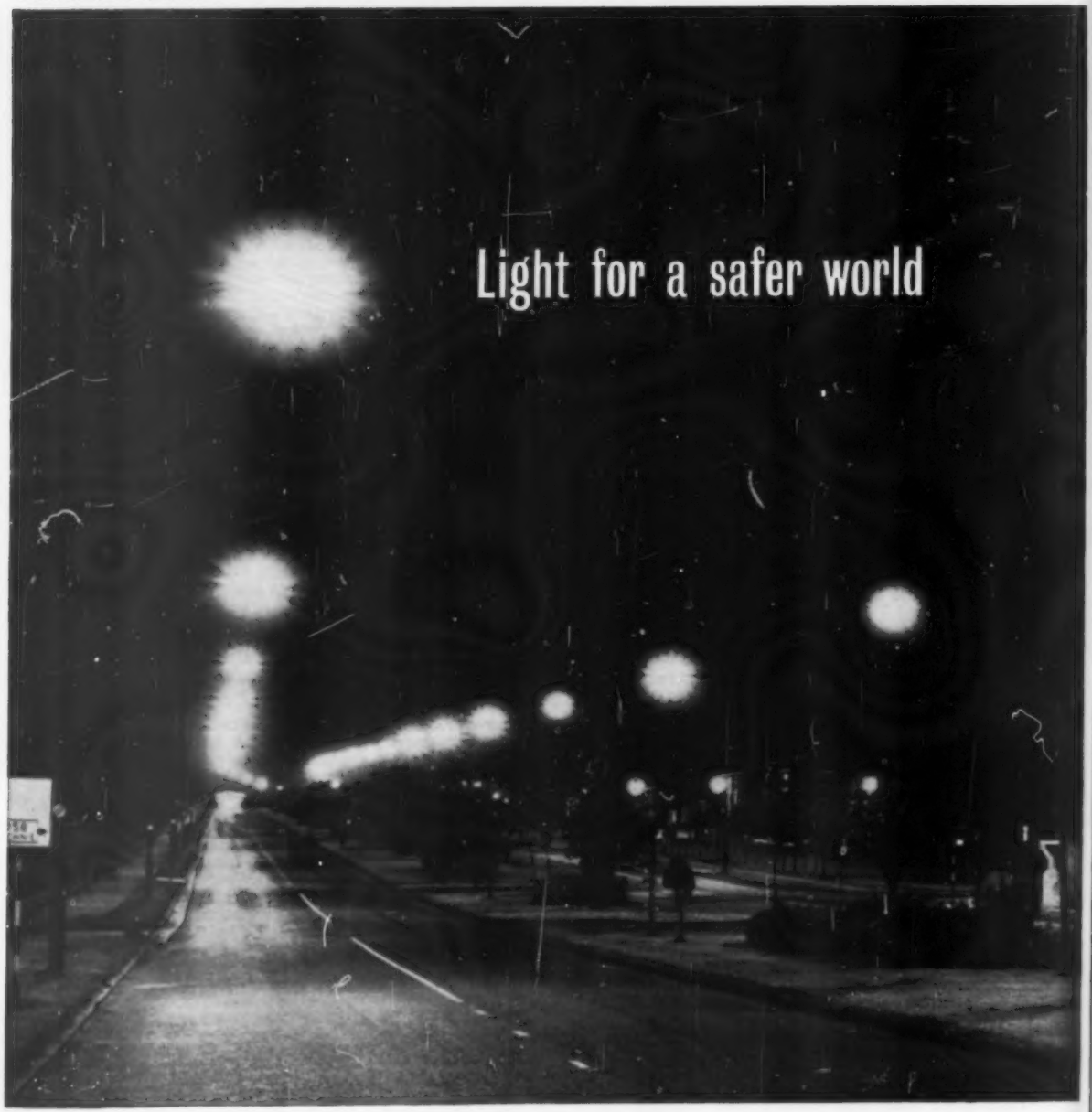
In Great Britain much of the basic information needed in dealing with lighting problems is being provided by the Traffic and Safety Division of the Road Research Laboratory and by research groups attached to lighting firms, and the results of the investigations carried out are, from time to time, included in annual reports of the Board or in technical papers.

In Italy, Switzerland and America investigations and experiments are going on in regard to the lighting of fast motorways and in the United States a recommended practice has already been produced dealing with the lighting of traffic tunnels and underpasses.

In France, Belgium and the Netherlands, as well as in this country, work has been carried out on the influence of road surfaces on lighting installations and also on the lighting of bridges from low mounted sources incorporated in bridge parapets.

The results of such investigations and of the full scale experiments that have

This illustration and the one overleaf show modern lighting by day and night on the Thurlaston roundabout at the junction of M1 and A45 with AEI 200 watt sodium linear lanterns.



With road safety a major consideration, this ¾-mile stretch on the main Glasgow-Edinburgh road is now lit by 52 high wattage Sodium lamps developed by Philips Electrical Ltd. The new system was largely the inspiration of Mr. Denis Colvin, Street Lighting Engineer to the County of Lanark, who co-ordinated the activities of Philips on lamps and gear, the Engineering & Lighting Equipment Co. Ltd. in their development of the new ELECO Golden Ray '280', and of Messrs. Stewarts and Lloyds, who provided the special steel columns. In operation it is no longer possible for confusion of light sources to be an accident hazard and the reduction of the number of columns used reduces the number of possible collision points.

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been carried out clearly indicate that the success of any measures undertaken to ensure the safe movement of pedestrians and vehicles is dependent on visibility. Even with the relatively low levels of lighting in use today, the provision of street lighting is very considerably easing both traffic and accident problems.

In establishing a relationship between street lighting and road accidents the Road Research Laboratory has made one of its major contributions to traffic engineering. The earlier evidence that modern street lighting tends to reduce the frequency of night accidents was obtained by the Laboratory from a limited number of sites in the London area. This conclusion was considerably strengthened by results obtained in the investigation of a further 52 sites in various parts of the country where obsolete lighting had generally been replaced by lighting designed in accordance with the Code of Practice for the Lighting of 'Traffic Routes'. The overall results of these investigations showed a 30 per cent all round reduction in night accidents and a pedestrian reduction of 45 per cent, and are in line with the results of similar experiments carried out in certain Continental countries.

It was also found by the R.R.L. that the average speed of vehicles had increased after the provision of modern street lighting, and in further investigations into speeds and accidents before and after street lighting improvements the reduction of 30 per cent in accidents was maintained when the average speed increased by 1.2 miles per hour.

Many street lighting installations are greatly affected by the reflection characteristics of the road surface, which vary with the condition and type of surfacing materials used. Experimental work in this direction has been carried on in Germany, Denmark and the United States, as well as by the Road Research Laboratory, which has compared the reflection characteristics of road surfaces in general use under both wet and dry weather conditions. The results clearly show the advantages to be gained at night from the use of light coloured materials both in surface dressings and in bituminous surfacings, and a white binder has already been used experimentally.

Lighting of Motorways

The lighting of flyovers on American and Continental motorways is today becoming general practice and, in recent years, both in France and the United States sections of motorway have been lighted in view of the growing around-the-clock use of such roads, and the increase in the number of fatal and serious accidents that has taken place.

On the Paris Autoroute de l'Ouest, with a relatively low level of lighting, night accidents have been reduced by some 40 per cent, and on American Expressways the reductions are said to be somewhat greater.

Although conditions necessarily vary from country to country, such evidence as is available indicates that the provision of lighting on motorways, between intersections, is likely to reduce night accidents by from 40 to 50 per cent. Although the number of personal-injury accidents to be expected on fast motorways is likely to be fewer than on all-purpose roads, the proportion of serious accidents and fatalities may be expected to be somewhat higher, and experience so far on the M.1 suggests that its use by night will be more dangerous than by day. The average speed of transport vehicles on motorways in France, Belgium and Germany is equivalent to from 36 to 43 miles per hour, and present vehicle lighting, particularly on such classes of vehicles, cannot be regarded as adequate for safe night driving. The glare or dazzle from vehicles moving on opposite carriageways is also a serious hazard to traffic, and has led to the erection on M.1 of an experimental two-mile stretch of anti-dazzle fencing at a cost of about £3,000 a mile.

For these reasons, and to ensure better visibility under bad weather conditions and less fatigue of vehicle drivers, it is becoming increasingly evident that 'road lighting is better than vehicle lighting' and before and after studies of unlighted and lighted sections are a necessity in the design of future motorways. The new high wattage linear sodium lamps have opened up new possibilities for the lighting of motorways, and they are already being used experimentally on fast traffic routes in Coventry, Glasgow and Leicester where they are mounted at 30 and 35 feet above the road and at distances apart of up to 200 feet, either on the central reservation or on each side of the dual carriageways. The cost of installing such lighting appears likely to be of the order of £4,000 to £5,000 per mile, depending on the type of installation used.

Economics of Improved Lighting

In considering alternative schemes for dealing with road and traffic problems, some assessment needs to be made so as to ensure that money is being used to the best advantage. In the case of the provision of street lighting on all-purpose roads, such information as is now available indicates that it can provide a greater accident reduction per mile of road, and at less cost, than obtained from many other minor improvement schemes. Also that the cost of providing lighting is not more than the financial savings arising from the reduction in night accidents. The further economic advantages of good lighting that arise from improved traffic flow and the better use of the road cannot, however, at the present time, be readily measured.

Stepping up Standards

While, in the main, street lighting installations in this country have been designed on the principle of silhouette vision, in which a pedestrian or vehicle is seen against the lighted background of the road surface, such considerations do not always apply in busy city streets at peak traffic periods when vehicles are travelling nose-to-tail.

In order to meet such changing traffic conditions experiments in Coventry have been carried out in both fluorescent and sodium lighting installations, whereby the light output is stepped up from 60 to 100 per cent during such period by clock control, the lighting reverting to normal main road lighting standard when the peak traffic period is passed.

Whether the maintenance of such higher levels of lighting during other periods might result in higher percentage reductions of night accidents and further increase traffic capacity in narrow streets can only be determined by the carrying out of more experiments. It is, however, apparent from trial installations on the Continent and in the United States that the provision of much higher standards of lighting is likely to be justified from a traffic and safety standpoint in the near future.

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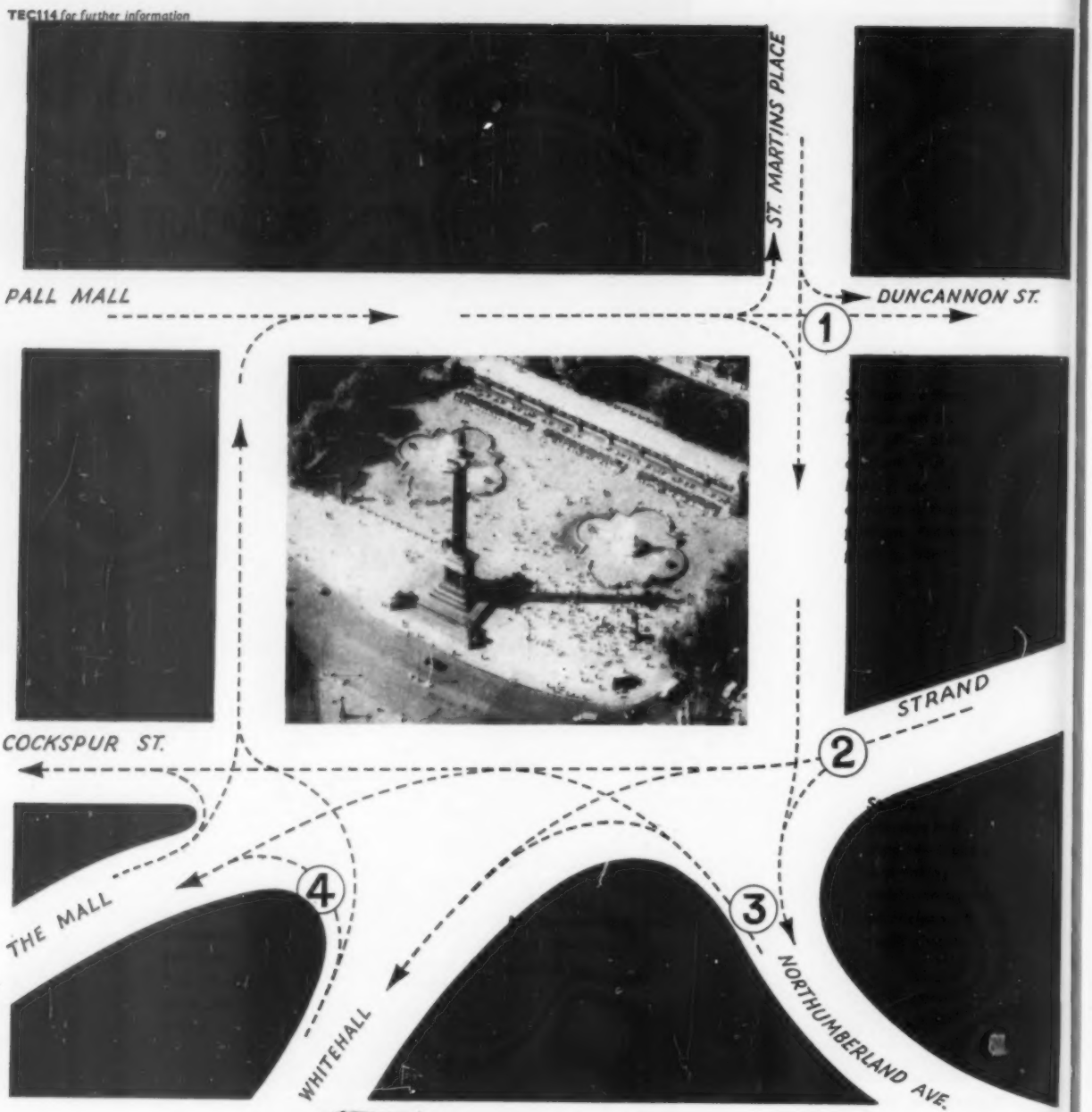

TYPE 54 CONTROLLER

After 26 years continuous operation, the complete "Electro-matic" installation controlling the approaches to Trafalgar Square has recently been modernised. The opportunity was taken by the City of Westminster to incorporate the latest technical developments in traffic signal control design to combat the great increase in traffic requiring to move through the area. The new system demonstrates their confidence in the vehicle-actuated principle of road traffic control and in the "Electro-matic" system in particular. The installation includes four "Electro-matic" Type 54 Controllers directed by a master timer thus providing a unique system of great flexibility ample for modern traffic conditions.

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ELECTRO-MATIC VEHICLE ACTUATED SIGNALS

A.T. 10151

At Westminster

For the first time ever the House of Commons debated traffic engineering on March 11, 1960, and carried the following motion moved by Mr. Norman Cole, Conservative Member for Bedfordshire:

> That this House welcomes the actions taken by the Government and by other bodies for research into and the practical application of traffic engineering and calls attention to the great potential in its increased use for the relief of traffic congestion.

Since this provided an opportunity for the Ministry of Transport to put on record its attitude to the subject we print below extracts from the speech of the Joint Parliamentary Secretary, Mr. John Hay.

If we are to live with the motor car, we need to plan our traffic; and to plan traffic includes an assessment of the functions of public transport. It includes the various methods open to us to improve existing roads and the measures necessary to provide new roads. It is in all these three fields in particular that the traffic engineer can help.

Traffic engineering consists of the application to road and traffic problems of common-sense, based on accurate analyses of traffic movement and on a knowledge of proper highway engineering. In short, what the traffic engineer really does is, by observation and collection of data, to analyse a given traffic situation. Having done that, he makes use of that knowledge and experience to provide the remedy.

There is no black magic in the idea of traffic engineering. It is an approach of applied science, and I think that anyone who has even the remotest connection with the subject realizes that traffic engineering does not pretend or claim to have any special advantages. A traffic engineer is almost invariably a highway engineer who has this special training and extra speciality which is of the greatest value to us at the moment.

Five Functions

The scope of traffic engineering consists in the study of five main groups of subjects. The first is the planning and traffic designing of new roads. The second is the physical improvement of existing roads. The third is the improvement of traffic movement by means of regulation and control of the traffic itself. The fourth is the planning and traffic design of what one might call the ancillaries to roads, arrangements for parking, access to premises the building of garages, and things of that kind. The final group of subjects to be dealt with is that of provision for pedestrians.

The proud aim of the traffic engineer in each of these groups of subjects is to reduce delay and congestion, increase the capacity of our roads and increase road safety. Common to all of them is the need to acquire information of traffic movement and accidents and then to analyse it. The acquisition of the information can be in respect of a whole area, perhaps a whole town or even a whole city, or it might relate to one particular traffic situation at one point. So far as the planning of new roads is concerned an early traffic appraisal is necessary, based on origin and destination. When that has been done, an economic assessment of the proposed roads can be reached. The best location can be decided upon and the detailed design, particularly of junctions and other features can be carried out.

The second part of the scope of traffic engineering is the physical improvement of existing roads. There has to be a co-ordinated plan, based again on the survey of the traffic needs. When the plan has been drawn up then the traffic engineer can go into action and make the necessary improvements. As I understand it, he does so in four principal ways—first, by the comparatively quick, cheap and simple measures such as the provision of traffic signs, the provision of lane or other road markings, matters which are comparatively easy to institute and which can be done without delay. Sometimes the situation requires a rather bigger operation and here various types of mandatory measures may be called for. For example, the institution of one-way streets, the abolition of right-hand turns, the installation of traffic lights or the imposition of waiting restrictions.

Next come the more complicated measures to deal with the situation. These may involve the substantial alteration of the layout of junctions, the provision of flyovers, flyunders or roundabouts. Before any of this can be done, a thorough analysis of traffic has to be carried out, and this is where the traffic engineer can help.

Parking

Traffic engineering must include measures to control parking on the streets and the traffic design of car parks and garages off the street. All these things are needed to form part of a comprehensive plan for an urban area based on a survey of parking habits, desires and possibilities. The traffic engineer must also understand lay-out and apply his experience to ascertain the nature and extent of the particular problem with which he is dealing. Only when he has done that can he select the solution.

Qualities Required

The traffic engineer must be a trained observer. He must be something of a statistician and something of a town planner, and he must have a good knowledge of highway design and construction. In addition, he must have common-sense and an understanding of human nature. It is not surprising that, because of all these necessary qualifications, traffic engineers are hard to find.

At present something in the region of twenty-two full-time traffic engineers and sixteen part-time traffic engineers are employed by the county council and county borough councils. From time to time, they go to other consultants to obtain specialized information and advice. The county councils include the London County Council, Lancashire and East Sussex County Councils and Oxfordshire. Among the county boroughs, Birmingham and Manchester are included, and there may be others.

We are not at all complacent about it. Frankly, this is something we are not satisfied about and we want to do better. However, I do not think that the answer is really for the Ministry of Transport to acquire to itself a vast staff of traffic engineers. We want them in the regions, in the service of the highway authorities. We have been trying to persuade the organizations of local authorities about traffic engineering for some time. It is a somewhat slow process, but I hope that it will get a little better after the House has expressed its view in the terms of this Motion.

* * *

As a postscript to Mr. Hay's definition of the functions of traffic engineering we add those of Sir Richard Nugent who preceded him as Joint Parliamentary Secretary at the Ministry of Transport, and who, while in office, took the initiative in advocating the greater application of traffic engineering techniques in this country.

Traffic engineering is primarily concerned with controlling and disciplining the movement of traffic.

Traffic engineering means essentially that we are prepared, in a system of traffic engineering, to accept patterns of movement worked out by the experts, whose results will bring about smoother and safer movement, and eliminate the conflicts which at present are causing congestion and, indeed, causing accidents. Traffic engineering is basically the application of the science of engineering to the movement of traffic on the roads, as distinct from highway engineering, which is the application of engineering to the construction of roads. The two are complementary.

Traffic engineering is not new in this country. That needs saying. Most of our highway engineers have been practising it for many years and particularly in connection with new construction, but its application to traffic movement here, has been rather sporadic. What is needed now is the comprehensive application of traffic engineering to whole cities and whole towns so that the whole movement is co-ordinated and planned from the centre, and that could have a dramatic effect in improving traffic movement, in achieving both a smoother flow and a safer flow and the elimination of traffic conflicts.

There are three things which have to be followed up. First, the training of traffic engineers so that we have a supply of the experts; secondly, getting the traffic authorities working in the cities; thirdly, enforcement. Those are the three pillars on which the working of smooth and safe traffic rests.

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A.P.124

ROAD PLANT and EQUIPMENT

A RECENT survey conducted for the *Roads Campaign Council* revealed that there is a considerable quantity of road equipment and plant lying idle at the present time which could quickly be put to work were the roads programme speeded up. Earth movers acquired for the construction of M1, and black-top machines of the latest type, are lying idle with dumpers, tractors and scrapers. The President of the Federation of Civil Engineering Contractors, Mr. Robert M. Douglas, commenting upon this uneconomic situation stated that, if the Government decided to spend an additional £100 million a year on the roads, Britain's contractors could easily handle the work. His confidence is based on a survey, conducted by the Federation, which revealed that the road equipment fleet had been increased by some 300 medium-sized excavators and 400 tractors and scrapers. These were previously employed on open-cast mining and were now available for work on the roads following the cut-back. Much concrete-laying machinery was also unemployed.

Muir-Hill Loader
The carrying position on the new loader made by E. Boydell & Co. of Old Trafford, Manchester, is claimed to eliminate spillage. Their new product, the Muir-Hill 2-WL Mk. II loader, incorporates a bucket roll-back of 50°, which should do away with ramming and accelerate loading. Features of the earlier model are incorporated. For special purposes, a Superlift variation on the 2-WL Mk. II is available with a forward reach of 7 ft. 7 in. and 14 ft. 8 in. upward reach.

For further details reference No. 2.

Narrow Width Dumper
Thwaites Engineering Co. of Cubbington, Leamington Spa, have recently introduced a new dumper to their range. This is a specially narrow machine with an over-all width of only 49¼ inches, but the skip capacity remains comparatively large—15 cubic feet. Loading height is 36 inches and the dumper has a turning circle of less than 7 ft. 9 in. Power comes from a Petter AVA 1 engine delivering 5/6 h.p. at 1,700 r.p.m., through a three speed constant mesh gearbox, to a hypoid axle with four star differential.

For further details reference No. 3

Electric Mixing
An electric mixer is on the market, designed to work on dry, semi-dry or wet mixes. It operates at a speed which makes it almost impossible to produce a badly mixed batch. A portable mixing pan, mounted on a steel chassis with pneumatic tyres to form a barrow, is wheeled under the mixing blades, which start automatically as the head is lowered into the pan. The blades adjust themselves to the correct angle and automatically swing clear of any large stones which accidentally get into the mix. To ensure long wear, parts are manganese tipped where possible, and can be easily changed when necessary.

The main advantages claimed by the manufacturers, Edward Benton & Co., Ferring, Worthing, Sussex, for this mixer are its high output and accurate mix.

For further details reference No. 4.

Liquid Gas Asphalt Heater
A mastic asphalt transporter/mixer has been recently developed by the Phoenix Engineering Co., Chard, Somerset. It is available in models with 2 or 4 ton capacity. The burners are of Barter design, and include a lockable control box with panelled instruments. The burner unit, burners and control instruments are all in one integral unit. Gas is supplied through a manifold from four gas bottles, but, as an extra, an automatic changeover valve is supplied, which allows the burners to operate from only two bottles at a time. Devices are incorporated to ensure maximum safety to operators and the machinery itself.

For further details reference No. 5.

New Tractor Shovel
A completely new tractor shovel is now in production at the Springfield Works of Allis-Chalmers Manufacturing Co. It is powered by a 79.5 h.p. diesel engine producing a drawbar pull of 16,670 lb. The HD.6G tractor shovel has a 1½ cu. yd. capacity and dumping height is now over 9 ft. 3 in. Forward reach at 8 ft. is 3 ft. 9½ in. The bucket, which has a curved bottom, has a roll-back of 40° and the break-out force at the cutting edge is 21,500 lb., 500 lb. heavier than the whole machine itself.

A variety of attachments are available for the front mounting and include both straight and angled dozers, rock bucket, rock fork, light materials bucket, lift tongs and forks and a crane hook.

British agents for this product are Mackay Industrial Equipment Ltd., Feltham, Middlesex.

For further details reference No. 6.

The Dempster-Dumpster System
A completely new range of mechanized equipment for handling materials in bulk will make its debut at the Mechanical Handling Exhibition at Earls Court in May. Known as the Dempster-Dumpster System, it is manufactured in the United Kingdom by Powell Duffryn Engineering Co. Ltd. It is an integrated system of vehicles and containers designed to facilitate the handling of all types of material in bulk. Standard makes of commercial chassis are utilized and versatile, tailor-made systems can be devised for the collection, transportation and dumping of a wide range of materials. Three of the main types of vehicle will be shown out of a range of five.

For further details reference No. 7.

ROAD MATERIALS

Road Use for Polythene
To speed up the laying of concrete carriageways, British Visqueen Ltd. have developed an underlay of polythene sheeting which can be unreeled direct on to the sub-grade. A special giant-sized dispenser is pulled by the compactor and the resulting surface is ready for the concrete train. By this method laying is speeded up and as much as 1,320 linear feet of completed carriageway can be laid in one day.

For further details reference No. 8.

Anti-Stripping
Armour Chemical Industries are the makers of an anti-stripping agent—Duomeen T. This is a mild alkali, R. NH. C_3H_6. NH_2., containing about 85 per cent pure amine. Duomeen T. is added to the binder in strengths varying with conditions, usually 1 per cent to 1½ per cent, and sprayed onto the road surface in the normal way. The makers claim that only in very unfavourable conditions of rain or snow need surfacing operations be suspended and that the road can immediately be used by traffic. Duomeen T. can be mixed with all the different forms of binder at present in use, but with certain tars having a high phenol content a slightly higher percentage of anti-stripping agent is required.

No claim is made by the manufacturers that Duomeen T. is a universal panacea for laying troubles. It is an anti-stripping agent to protect surfaces from water and all the usual care must be taken with equipment and materials.

For further details reference No. 9.

Waterproof Paint Additive
The R.A.C. road-signs department is at present carrying out tests on the Romnay paint additive, which has been developed to improve the active adhesion of paint to surfaces which are not completely free from moisture. It is claimed that it will displace any surface dampness and allows it to evaporate at the same time as the solvents in the paint. Assuming this claim to be true, the Romnay paint additive will find many uses in road marking.

The Selros Agencies, 129 Church Street, N.16 are the distributors on behalf of H. W. Roemmely & Co., Glasgow.

For further details reference No. 10.

Passenger shelters to please travellers

Travellers respond favourably to the amenities provided by Tyler Shelters. They are obviously designed and erected to meet modern-day travelling conditions. This appreciation is shared by the many local authorities who have specified them.

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STREET FURNITURE

Manually-operated Meter

A demonstration of a manually-operated parking meter was given to members of the Traffic Engineering Study Group of the Institution of Civil Engineers, during a recent visit to the Wembley plant of the Siemens and General Electric Signal Company. So far only automatically operated meters have been installed in this country, but with the certain increase in the use of parking meters with provision for their speedier authorization under the new Road Traffic Bill, it is anticipated there will be more experimentation and greater variation in types used. The advantage claimed for the manually-operated meter is its greater economy of operation inasmuch as there is no winding expense, springs are only under tension whilst selling time, and the mechanism can be easily lifted out for maintenance.

The Duncan-Miller '60' Parking Meter.

The Duncan-Miller '60' meter, demonstrated by Mr. C. Stringer, Sales Engineer, Road Signals, is in effect operated by the motorist himself. After inserting the appropriate coin he turns the handle clockwise to its full extent and winds the spring. On release the handle returns to its normal position and time purchased is indicated in the usual way by a pointer on the dial. The clockwork timer is thus set in motion and the pointer times back to zero. When the purchased time expires the red flag stating 'Time Expired' appears and is visible through both the front and rear windows.

The mechanism, which consists of a clockwork-timer employing a balance wheel and lever escapement, and of an interchangeable sealed coin-box, is housed in a corrosion-resistant weatherproof casting.

The form of installation has been specially designed to foil vandalism and theft. The base of the meter itself is fitted with three expander jaws which lie against a tapered spigot. An expander bolt passing through from the coin box compartment is coupled to these jaws by a three-pronged expander nut.

With the expander jaws bolt slackened off, the base of the meter is fitted into the post where it rests on the rim. When the bolt is tightened the expander jaws are drawn upwards and at the same time forced outwards to form wedges between the inside of the post and the tapered spigot. (See illustration.) This provides a very effective clamp making it impossible to remove the meter without first gaining access to the coin box compartment and then unscrewing the expander bolt.

For further details reference No. 11.

An Automatic Meter

In contrast to the meter described above, the 'Karpark' mechanism is fully automatic. The insertion of the appropriate coin sets and starts the timing apparatus, leaving no handles to be turned, and no plungers or levers to be operated.

The 'Karpark' meter is available in two forms, single and twin-headed, and these have been adapted to take many different foreign coins. The mechanisms are complete, interchangeable units, which simplify service and repairs. The housing, currently the only one included in the CoID Approved List, is made of strong, anodized alloy finished in a wide choice of coloured enamel.

For further details reference No. 12.

Road Obstruction Warning

A device is now available for warning drivers when there is an obstruction or vehicle parked in the carriageway. It consists of a collapsible metal triangle made from aluminium strips, two inches wide and fifteen inches in length, covered with 'Scotchlite' reflective tape. The triangle can be stood firmly in the road to give advance warning to any approaching traffic. It is simple, easy to use and is claimed to reflect the headlights of a vehicle from more than 400 yards. There is no maintenance involved and in its collapsed form is easily stored in the smallest car. It conforms with the new ruling now in force in Italy for all vehicles to be equipped with some form of warning signal. The makers are Drawing Materials Co., 87/89 Edmund Street, Birmingham.

For further details reference No. 13.

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DATES FOR THE TRAFFIC ENGINEER

May 3—Institution of Civil Engineers.
Symposium on London/Birmingham Motorway. Speakers:—J. F. A. Baker, W. H. Glanville, Sir Owen Williams, W. K. Laing, B. H. Broadbent, J. M. Fisher, Col. C. H. ffolliott and Col. T. McMillan.

May 17—Royal Institute of British Architects.
Paper—Planning and Controlled City Growth by Senhor Lobato.

May 17—Institution of Civil Engineers.
Paper—Port of London Authority; development of two dock areas, 1959. Speakers:—D. E. Glover, E. Newton, H. M. Dale and T. R. Brown.

May 20-22—Institute of Traffic Administration.
Annual Conference at Black Boy Hotel, Nottingham. Conference Fees; Graduates, Students and their Ladies 21s.

May 24—Institution of Civil Engineers.
Papers—The new highway bridges across the River Tigris in Iraq at Amara and Kut. Speakers:—W. E. Gelson and G. A. Plank.
The analysis of steel decks with special reference to the highway bridges at Amara and Kut, Iraq. Speakers:—B. Farago and W. W. L. Chan.

May 26—Institution of Civil Engineers.
Film Evening: 'London/Birmingham Motorway', and 'The Changing Face of London.'

June 9-10—Institution of Highway Engineers.
Paper—K. Summerfield, Esq., M.SC., A.M.I.C.E., M.INST.H.E., County Surveyor, Oxfordshire.

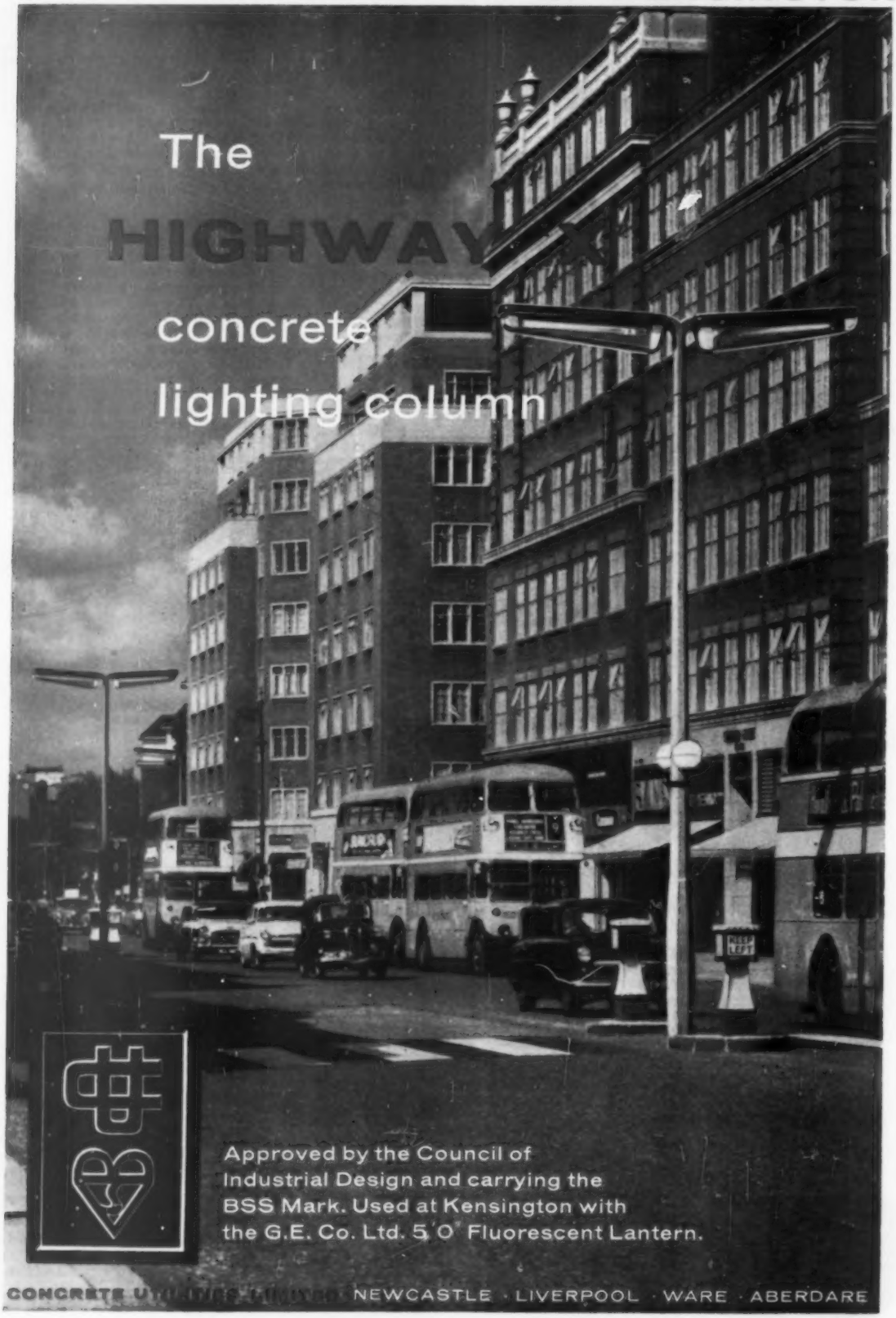
July 4-August 14—South African Road Federation, Johannesburg.
Winter School in Highway Engineering. For further details contact: The Secretary, South African Road Federation, P.O. Box 8189, Johannesburg, S.A.

September 12-16—Institute of Traffic Engineers (U.S.A.).
30th Annual Meeting at Edgewater Beach Hotel, Chicago, Illinois.

September 28 - October 1 — Fifth International Traffic Study Week, Nice, France.
For further details contact:—World Touring and Automobile Association, 32 Chesham Place, London, S.W.1.

October 3-5—International Road Safety Congress, Nice, France.
For further details contact:—Overseas Touring Association, 32 Chesham Place, London, S.W.1.

THE ROYAL BOROUGH OF KENSINGTON



TRAFFIC CONTROL DEVICES

Members of the Traffic Engineering Study Group of the Institution of Civil Engineers recently visited the Wembley plant of the Siemens and General Electric Railway Signal Company, to inspect new road traffic controllers and signals. The visit was arranged by the Commercial Engineer, Mr. E. G. Henderson. Chief interest centred in the Autoflex Controller Type 15 designed and produced in accordance with the new requirements of the Ministry of Transport which have been circulated to the authorities concerned, appropriate manufacturers and others interested but have not yet been promulgated.

Demonstration of the new controller was given by Mr. H. J. N. Riddle, the company's designer and development engineer in association with the Manager, Mr. F. G. Mitchel. A set of traffic signals and detectors were used and their operation reproduced on a typical intersection layout showing normal cabling, pedestrian crossing and alternative stop line formations.

The basic principles and features of the Autoflex system are:

(a) A vehicle traversing a detector on the road having right-of-way, under normal conditions, passes through the junction before a conflicting flow of traffic is given the right-of-way.

(b) Under conditions of continuous traffic on one road, a vehicle approaching on another will not be kept waiting for more than the pre-set maximum green period or periods. If all roads carry continuous traffic, the right-of-way is given to each road in turn for the respective maximum periods.

(c) Vehicles approaching a junction on the road not having right-of-way will secure an immediate change provided no traffic has been detected on a conflicting road or roads, or—

(d) If there is traffic on the conflicting road the right-of-way will be given during the first gap that occurs in the running traffic; failing this, at the expiry of the maximum green period or periods, which will be timed from the moment the vehicle calling for the change crosses its detector.

(e) When a change is made upon the expiry of the maximum green period, the right-of-way will later revert to the phase from which it had been taken.

(f) In the absence of traffic the right-of-way will remain on the road to which it was last given.

(g) Minimum green periods are automatically variable depending upon the number of vehicles waiting at a red signal for right-of-way. There is a choice of two ranges of minimum green period for each phase from 8 to 15 seconds and 10 to 15 seconds.

(h) The process of changing right-of-way from one road to another includes a 3-second amber period displayed to the road losing right-of-way and a 2-second amber-with-red period preceding the green.

The relationship of the two amber periods can be adjusted to give 'intergreen' periods of any duration from 4 seconds to 12 seconds and is illustrated below.

(j) The duration of the 'intergreen' periods can either be fixed or automatically varied in accordance with traffic requirements. For this purpose the 'intergreen' may be extended beyond 12 seconds, a separate adjustment being available for every possible change of right-of-way.

(k) Extensions to right-of-way are made inversely proportional to vehicle speeds thus allowing a slow-moving vehicle, such as a horse-drawn conveyance, a longer period of green to traverse the signalled area. This 'speed timing' is non-additive, giving times as accurately for single vehicles as for groups of vehicles of mixed speeds.

The timing circuit is governed by an electronic timing means for measuring off the intergreen, minimum green and maximum green periods for speed timing. This timer operates at only 50 volts d.c. and uses simple thermionic (radio) valves.

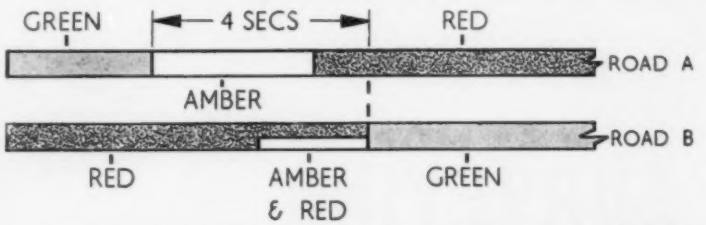
Demonstration was also given of the two-phase Pedestrian (Push-button) Actuated Controller with its three aspect signal for vehicle control and two aspect, Red and 'Cross Now', for pedestrians.

The advantages of this installation are that it gives a clear indication to approaching vehicles of the need to stop as and when required, and when stopped it provides an equally clear indication to pedestrians that traffic is held by red signals. Further, under peak conditions the traffic period ensures that traffic is regularly released and for a sufficient time of unhindered passage, while pedestrians are at the same time collected into groups ready to cross expeditiously when the 'Cross Now' period starts, provided they exercise the necessary patience and discipline.

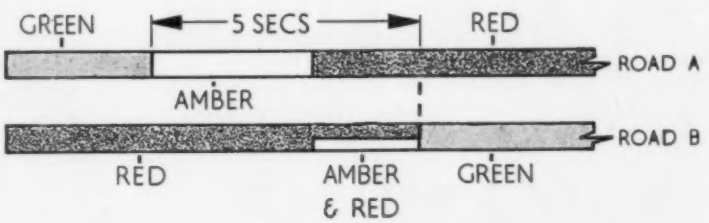
Any period of 'Cross Now' indication can be selected from the following: 1, 2, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30, 35, 40, 45, 50, 55, 60 seconds. The selection is simply carried out be inserting a plug-lead marked 'PED' into any one of the sockets corresponding to the above timings.

Any period of traffic flow following a pedestrian period may similarly be selected out of the same range by suitably positioning a plug-lead marked 'A GREEN'. If special protection in the form of an all-red clearing period after or before the pedestrian period is necessary an additional plug-lead, or leads, is provided and enables clearing periods of from one second upward to by inserted.

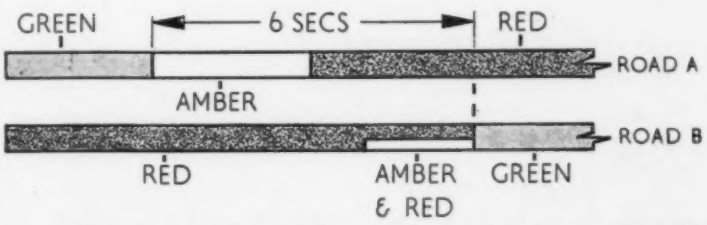
The apparatus is housed in a cast aluminium case (overall dimensions—30 in. high, 11 in. wide, 8 in. deep, exclusive of hinges and fastenings) suitable for post or wall mounting, and space is provided for a time switch if required. *For further details reference No.* 14.



An intergreen period of 4 seconds which is the shortest timing obtainable.



A 5-second intergreen period provides sequent ambers.



A 6-second intergreen period provides separate ambers and 1-second all red.

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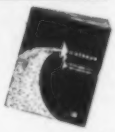

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